BERGEN COUNTY
WILLIAMS CENTER FOR THE ARTS

15 SYLVAN ST
RUTHERFORD, NJ, 07070

FACILITY ENERGY REPORT

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I. HISTORIC ENERGY CONSUMPTION/COST

The energy usage for the facility has been tabulated and plotted in graph form as depicted within this section. Each energy source has been identified and monthly consumption and cost noted per the information provided by the Owner.

Electric Utility Provider:	Public Service Electric & Gas
Electric Utility Rate Structure:	General Lighting & Power (GLP)
Third Party Supplier:	None

Natural Gas Utility Provider:	Public Service Electric & Gas
Utility Rate Structure:	Large Volume Gas (LVG)
Third Party Supplier:	None

The electric usage profile represents the actual electrical usage for the facility. The electric utility measures consumption in kilowatt-hours (KWH) and maximum demand in kilowatts (KW). One KWH usage is equivalent to 1000 watts running for one hour. One KW of electric demand is equivalent to 1000 watts running at any given time. The basic usage charges are shown as generation service and delivery charges along with several non-utility generation charges. Rates used in this report reflect the historical data received for the facility.

The gas usage profile within each facility report shows the actual natural gas energy usage for the facility. The gas utility measures consumption in cubic feet x 100 (CCF), and converts the quantity into Therms of energy. One Therm is equivalent to 100,000 BTUs of energy.

Table 1
Electricity Billing Data

ELECTRIC USAGE SUMMARY

Utility Provider: PSE&G
Rate: GLP
Meter No: 278003797, 778013328
Account # 67 528 602 03, 66 369 000 08
Third Party Utility Provider: None
TPS Meter / Acct No: -

MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
Mar-10	30,480	152.2	$5,160
Apr-10	27,810	185.8	$5,028
May-10	28,760	161.6	$5,346
Jun-10	40,090	279.3	$8,401
Jul-10	53,250	220.6	$10,588
Aug-10	59,230	224.0	$11,565
Sep-10	56,150	185.5	$10,445
Oct-10	45,430	172.4	$7,593
Nov-10	56,430	216.1	$10,155
Dec-10	35,640	106.6	$5,607
Jan-11	31,370	104.9	$5,183
Feb-11	32,380	113.1	$5,564
Totals	**497,020**	**279.3 Max**	**$90,635**

AVERAGE DEMAND **176.8 KW average**
AVERAGE RATE **$0.182** **$/kWh**

Figure 1
Electricity Usage Profile

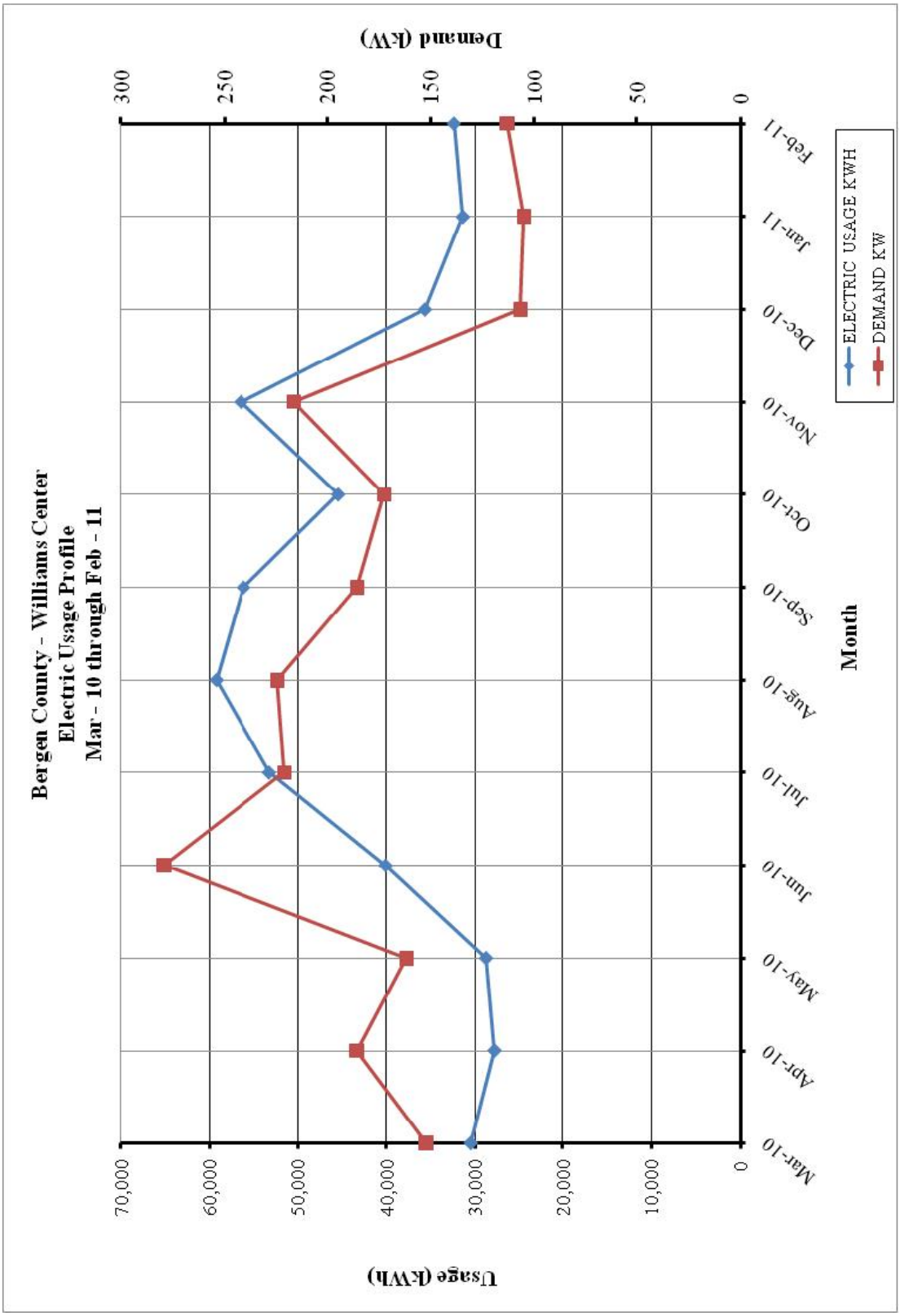
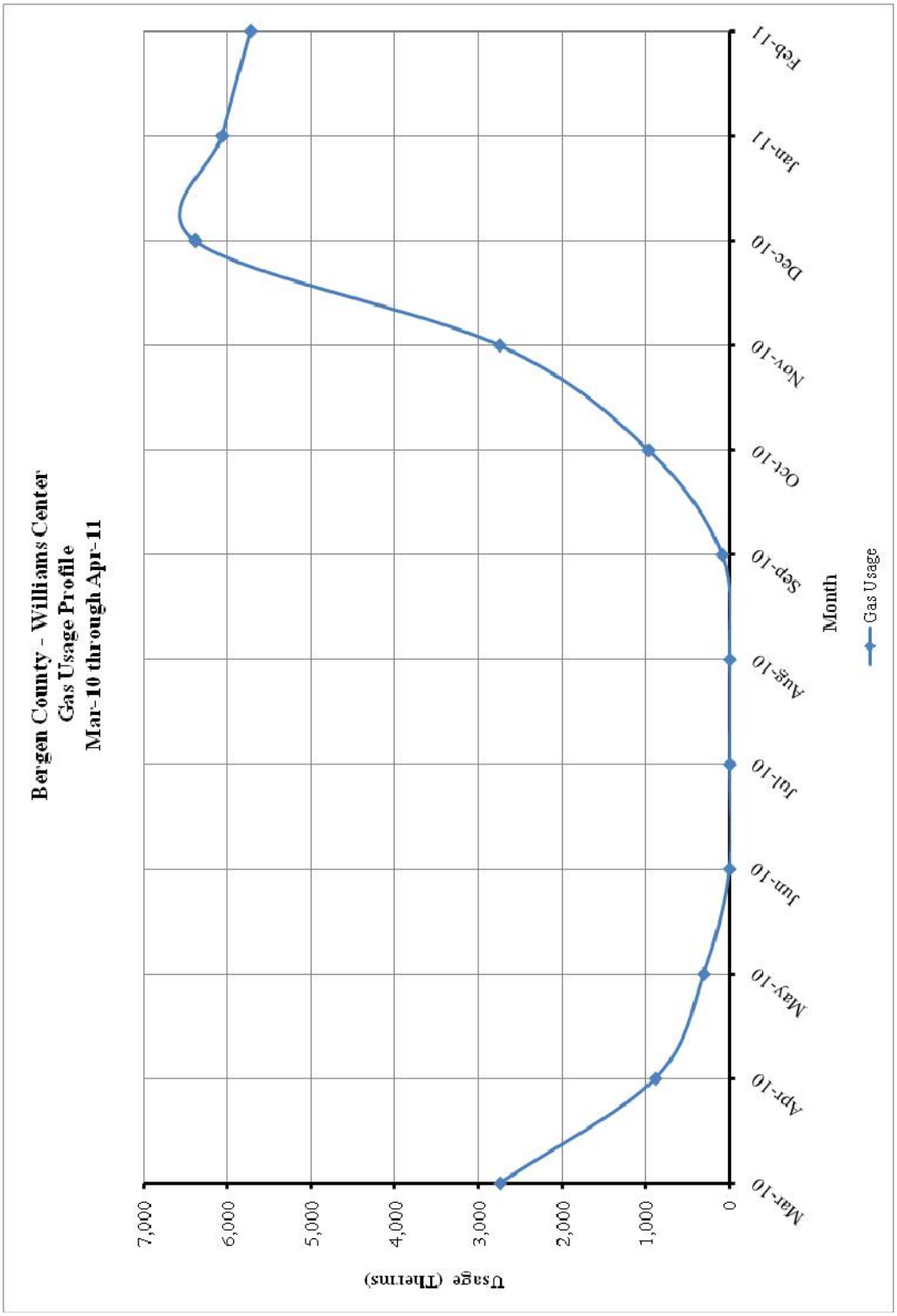


Table 2
Natural Gas Billing Data

NATURAL GAS USAGE SUMMARY		
Utility Provider: PSE&G		
Rate: LVG		
Meter No: 3499913		
Point of Delivery ID: 66 369 000 08		
Third Party Utility Provider: None		
TPS Meter No: -		
MONTH OF USE	**CONSUMPTION (THERMS)**	**TOTAL BILL**
Mar-10	2,746.57	$2,823.47
Apr-10	890.56	$914.61
May-10	311.70	$319.18
Jun-10	3.04	$3.10
Jul-10	0.00	$0.00
Aug-10	0.00	$0.00
Sep-10	92.09	$94.49
Oct-10	972.53	$997.82
Nov-10	2,751.63	$2,814.92
Dec-10	6,389.77	$6,523.95
Jan-11	6,065.93	$6,199.38
Feb-11	5,726.91	$5,870.08
TOTALS	**25,950.72**	**$26,560.98**
AVERAGE RATE:	**$1.02**	**$/THERM**

Figure 2
Natural Gas Usage Profile



II. FACILITY DESCRIPTION

The 39144 SF William Center for the Arts is a three story facility comprised of a live stage, four (4) movie theatres, administrative offices, concession area, bathrooms, mechanical rooms and storage areas.

The center opens everyday at 9:00 AM. On weekdays the movie theaters operate during the evening between the hours of 6:00 PM and 9 PM. On weekends the movie theatres operate day and night sessions with the last one ending at 11:30 PM. In addition, the live stage is used occasionally for various events including a church gathering on Sunday mornings.

Exterior walls of the facility are brick construction. The amount of insulation within the wall is unknown. The facility consists of a glass atrium which houses the lobby and the ticketing area. The atrium is comprised of single pane tinted windows with metal frames. The atrium windows are in very poor condition with several cracks and leaks. There are minimal amount of windows in the rest of the facility.

The main structure has a fairly new slightly pitched built-up roof with asphalt shingle covering. The amount of insulation below the roofing is unknown. The facility was originally built in 1920s. In 1970, the building suffered severe fire damage and it was rebuilt. Finally, in 2009 new HVAC units were installed.

The capacities of the William Center theaters are as follows:

Theatre #1:	192 People
Theatre #2:	90 People
Theatre #3:	60 People
Theatre #4:	125 People
Live Stage:	641 People (+200 Standing)

HVAC Systems

The central heating system consists of two (2) Paterson Kelley 1900 series water tube, gas fired, standard hot water boilers with a total input capacity of 3,800 MBH. The boilers produce heating hot water for the air handling units. The boiler water is pumped throughout the facility by two (2) constant volume 10 HP base mounted end suction pumps (one operating / one standby) made by Taco. The pumps are coupled with standard efficiency motors.

The central cooling system consists of a 200-ton air cooled, standard efficiency, packaged water chiller made by TRANE. The chiller was installed during the recent renovation in performed in 2009 and it appears to be in excellent condition. Chilled water is distributed throughout the building to the air handling units via two (2) constant volume 20 HP base mounted end suction pumps. The pumps are driven by high efficiency motors made by Baldor.

The air side systems include air handling units feeding the theatres, concession area, offices, projector rooms and lobby. The air handling units provide heating and cooling to the building year round. All of the air handling units utilize 2-way control valves for both the heating and

cooling coils. Ventilation air for the theatres is provided by outside air dampers at each air handling unit.

The air handling units AC#1-5 feeding the concession area, theatres #1, 2 and 2A are pre-existing McQuay units before the 2009 renovation. In addition, a larger air handling unit, AC-14 made by Trane feeds the Newman Theatre. Each unit is equipped with hot and chilled water coils, constant volume supply fans and standard efficiency motors. The units are in good condition.

The air handling units AC#6, 7 and 8 feeding the offices, theater #3, mezzanine and the lobby are new units installed during the 2009 renovation. These units are suspended in the ceiling of the third floor mechanical room. Similarly, these units are constant volume units with hot and chilled water coils for primary air heating and cooling.

Exhaust System

Air is exhausted from the toilet rooms, boiler rooms and projector rooms through the roof exhausters. The exhaust fans are operated based on the facility occupancy schedule.

HVAC System Controls

The HVAC system includes a central control system made by Honeywell. The system integrates into the majority of the equipment including boilers, chillers, pumps and air handling units. The system includes all electronic controls for actuators and control valves. The front end controller has the capability to monitor and control all schedules, thermostat temperatures and set points. The control system also automates the night time temperature setback based on occupancy schedules.

Domestic Hot Water

Domestic hot water for the stage restrooms is provided by a 40 gallon Rheem electric hot water heater with 4500 Watts of heating capacity. The domestic hot water piping insulation appeared to be in good condition.

Lighting

The lighting throughout the Williams Center is provided with variety of lighting technologies including outdated fixtures with T12 lamps, newer fixtures with T8 lamps, incandescent lamps and high intensity discharge lights such as quartz lights in the main assembly area.

III. MAJOR EQUIPMENT LIST

The equipment list contains major energy consuming equipment that through implementation of energy conservation measures could yield substantial energy savings. The list shows the major equipment in the facility and all pertinent information utilized in energy savings calculations. An approximate age was assigned to the equipment in some cases if a manufactures date was not shown on the equipment's nameplate. The ASHRAE service life for the equipment along with the remaining useful life is also shown in the Appendix.

Refer to the **Major Equipment List Appendix** for this facility.

IV. ENERGY CONSERVATION MEASURES

Energy Conservation Measures are developed specifically for this facility. The energy savings and calculations are highly dependent on the information received from the site survey and interviews with operations personnel. The assumptions and calculations should be reviewed by the owner to ensure accurate representation of this facility. The following ECMs were analyzed:

Table 3
ECM Financial Summary

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST[A]**	**ANNUAL SAVINGS[B]**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
ECM #1	Lighting Equipment Upgrade	$13,787	$8,644	1.6	840.5%
ECM #2	Lighting Controls Upgrade	$3,570	$1,912	1.9	703.2%
ECM #3	Premium Efficiency Motors	$10,768	$597	18.1	-16.9%
ECM #4	Variable Frequency Drives on Pump Motors	$33,550	$5,249	6.4	212.9%
ECM #5	Window Replacement	$133,500	$3,265	40.9	-63.3%
ECM #6	Demand Controlled Ventilation	$128,000	$9,191	13.9	7.7%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST**	**ANNUAL SAVINGS**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	Solar Photovoltaic System	$101,430	$7,546	13.4	11.6%

Notes: A. Cost takes into consideration applicable NJ Smart StartTM incentives.
B. Savings takes into consideration applicable maintenance savings.

Table 4
ECM Energy Summary

ENERGY CONSERVATION MEASURES (ECM's)				
ECM NO.	**DESCRIPTION**	**ANNUAL UTILITY REDUCTION**		
		ELECTRIC DEMAND (KW)	**ELECTRIC CONSUMPTION (KWH)**	**NATURAL GAS (THERMS)**
ECM #1	Lighting Equipment Upgrade	19.3	45,722	0
ECM #2	Lighting Controls Upgrade	0	10,504	0
ECM #3	Premium Efficiency Motors	0.8	3,509	0
ECM #4	Variable Frequency Drives on Pump Motors	0	45,969	0
ECM #5	Window Replacement	1.7	4,747	2,354
ECM #6	Demand Controlled Ventilation	0	24,485	4,642
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	**DESCRIPTION**	**ANNUAL UTILITY REDUCTION**		
		ELECTRIC DEMAND (KW)	**ELECTRIC CONSUMPTION (KWH)**	**NATURAL GAS (THERMS)**
REM #1	Solar Photovoltaic System	11.3	14,185	0

Table 5
Facility Project Summary

ENERGY SAVINGS IMPROVEMENT PROGRAM - POTENTIAL PROJECT					
ENERGY CONSERVATION MEASURES	**ANNUAL ENERGY SAVINGS ($)**	**PROJECT COST ($)**	**SMART START INCENTIVES**	**CUSTOMER COST**	**SIMPLE PAYBACK**
Lighting Equipment Upgrade	$8,644	$15,837	$2,050	$13,787	1.6
Lighting Controls Upgrade	$1,912	$3,750	$180	$3,570	1.9
Premium Efficiency Motors	$597	$11,163	$395	$10,768	18.1
Variable Frequency Drives on Pump Motors	$5,249	$34,000	$450	$33,550	6.4
Window Replacement	$3,265	$133,500	$0	$133,500	40.9
Demand Controlled Ventilation	$9,191	$128,000	$0	$128,000	13.9
Design / Construction Extras (15%)		*$48,938*		*$48,938*	
Total Project	**$28,857**	**$375,188**	**$2,500**	**$372,113**	**12.9**

Design / Construction Extras is shown as an additional cost for the facility project summary. This cost is included to estimate the costs associated with construction management fees for a larger combined project.

ECM #1: Lighting Equipment Upgrade

Description:

The lighting throughout the Williams Center is provided with variety of lighting technologies including outdated fixtures with T12 lamps, newer fixtures with T8 lamps, incandescent lamps and high intensity discharge lights such as quartz lights in the main assembly area.

This ECM includes re-lamping and re-ballasting of the existing T12 fluorescent fixtures and 700 series fluorescent T8 fixtures with 800 series, 28W T8 lamps. The new, energy efficient fixtures with supersaver T8 lamps will provide adequate lighting and will save on electrical costs due to better performance of the lamp and ballasts. This ECM also includes maintenance savings through the reduced number of lamps replaced per year. The expected lamp life of a T8 lamp is approximately 30,000 burn-hours, in comparison to the existing T12 lamps which is approximately 20,000 burn-hours. The facility will need approximately 33% less lamps replaced per year for each one for one fixture replaced.

The ECM also includes replacement of any incandescent lamps with compact fluorescent lamps. Compact fluorescent lamps (CFL's) were designed to be direct replacements for the standard incandescent lamps which are common to table lamps, spot lights, hi-hats, bathroom vanity lighting, etc. The energy usage of an incandescent lamp compared to a compact fluorescent lamp is approximately 3 to 4 times greater. In addition to the energy savings, compact fluorescent fixtures burn-hours are 8 to 15 times longer than incandescent fixtures ranging from 6,000 to 15,000 burn-hours compared to incandescent fixtures ranging from 750 to 1000 burn-hours. However, the maintenance savings due to reduced lamp replacement is offset by the higher cost of the CFL's compared to the incandescent lamps.

This ECM also includes replacement of some of the dimmable incandescent bulbs to LED bulbs. Self contained LED fixtures with dimmable power supplies provide controllable light with four times less energy use. LED bulbs are available in a variety of temperatures to produce different light colors. In addition to the energy savings, dimmable LED bulbs burn-hours are approximately 24 times longer than incandescent fixtures.

Energy Savings Calculations:

The **Investment Grade Lighting Audit Appendix** outlines the hours of operation, proposed retrofits, costs, savings, and payback periods for each set of fixtures in the each building.

Rebates and Incentives:

NJ Smart Start® Program Incentives are calculated using the **Smart Start® Incentive Appendix** as follows:

Retrofit of T-12 fixtures to T-5 or T-8 with electric ballasts	$10 per fixture (1-4 lamp retrofits)

$$\text{Smart Start® Incentive} = (\#\ \text{of fixtures} \times \$10) = 44 \times \$10 = \$440$$

LED Screw-based & Pin-based (PAR, MR, BR, R) Standards (A-Style) and Decorative (globe, candelabra, etc.) Lamps	$20 per lamp

$$\text{Smart Start® Incentive} = (\#\ \text{of lamps} \times \$20) = 63 \times \$20 = \$1260$$

$50 per HID (≥100w) fixture retrofitted with induction lamp	$50 per HID (≥100w) fixture retrofitted with induction lamp, power coupler and generator.

$$\text{Smart Start® Incentive} = (\#\ \text{of fixture} \times \$50) = 7 \times \$50 = \$350$$

Replacement and Maintenance Savings are calculated as follows:

Due to replacing T12 lamps with T8s

$$\text{Savings} = (\text{reduction in T8 lamps replaced per year}) \times (\text{repacment \$ per lamp} + \text{Labor \$ per lamp})$$

$$\text{Savings} = 2.91 \times (\$2\ \text{per lamp} + \$5\ \text{per lamp}) = \$20$$

Due to replacing incandescent lamps with LEDs

$$\text{Savings} = (\text{reduction in lamps replaced per year}) \times (\text{repacment \$ per lamp} + \text{Labor \$ per lamp})$$

$$\text{Savings} = 60.48 \times (\$2\ \text{per lamp} + \$3\ \text{per lamp}) = \$302$$

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$15,837
NJ Smart Start Equipment Incentive ($):	$2,050
Net Installation Cost ($):	$13,787
Maintenance Savings ($/Yr):	$323
Energy Savings ($/Yr):	$8,321
Total Yearly Savings ($/Yr):	$8,644
Estimated ECM Lifetime (Yr):	15
Simple Payback	1.6
Simple Lifetime ROI	840.5%
Simple Lifetime Maintenance Savings	$4,841
Simple Lifetime Savings	$129,661
Internal Rate of Return (IRR)	63%
Net Present Value (NPV)	$89,405.50

ECM #2: Lighting Controls Upgrade – Occupancy Sensors

Description:

Some of the lights in this facility are left on unnecessarily. In many cases the lights are left on because of the inconvenience to manually switch lights off when a room is left or on when a room is first occupied. This is common in rooms that are occupied for only short periods and only a few times per day. In some instances lights are left on due to the misconception that it is better to keep the lights on rather than to continuously switch lights on and off. Although increased switching reduces lamp life, the energy savings outweigh the lamp replacement costs. The payback timeframe for when to turn the lights off is approximately two minutes. If the lights are expected to be off for at least a two minute interval, then it pays to shut them off.

Lighting controls come in many forms. Sometimes an additional switch is adequate to provide reduced lighting levels when full light output is not needed. Occupancy sensors detect motion and will switch the lights on when the room is occupied. Occupancy sensors can either be mounted in place of a current wall switch, or on the ceiling to cover large areas.

The U.S. Department of Energy sponsored a study to analyze energy savings achieved through various types of building system controls. The referenced savings is based on the "Advanced Sensors and Controls for Building Applications: Market Assessment and Potential R&D Pathways," document posted for public use April 2005. The study has found that commercial buildings have the potential to achieve significant energy savings through the use of building controls. The average energy savings are as follows based on the report:

- Occupancy Sensors for Lighting Control 20% - 28% energy savings.

Savings resulting from the implementation of this ECM for energy management controls are estimated to be 25% of the total light energy controlled by occupancy sensors and daylight sensors (The majority of the savings is expected to be after school hours when rooms are left with lights on)

This ECM includes installation of ceiling or switch mount sensors for individual offices, classrooms, large bathrooms, and libraries. Sensors shall be manufactured by Sensorswitch, Watt Stopper or equivalent. The **Investment Grade Lighting Audit Appendix** of this report includes the summary of lighting controls implemented in this ECM and outlines the proposed controls, costs, savings, and payback periods. The calculations adjust the lighting power usage by the applicable percent savings for each area that includes lighting controls.

Energy Savings Calculations:

$$\text{Energy Savings} = (\%\ \text{Savings} \times \text{Controlled Light Energy}\ (\text{kWh/Yr}))$$

$$\text{Savings.} = \text{Energy Savings}\,(\text{kWh}) \times \text{Ave Elec Cost}\left(\frac{\$}{\text{kWh}}\right)$$

Cost and Incentives:

Installation cost per dual-technology sensors (Basis: Sensor switch or equivalent) are as follows:

Dual Technology Occupancy Sensor - Switch Mount	$125 per installation
Dual Technology Occupancy Sensor - Remote Mount	$450 per installation
Dual Tech. Occupancy Sensor w/2 Pole Relay - Remote Mount	$500 per installation
Daylight Sensor (Sensorswitch PP-20 & CM-PC or equal)	$400 per installation

Cost includes material and labor.

From the **NJ Smart Start® Program Incentives Appendix**, the installation of a lighting control device warrants the following incentive:

Occupancy Sensor Fixture Mounted (existing facility only) = $20 per sensor
Occupancy Sensor Remote Mounted (existing facility only) = $35 per sensor

$$\text{Smart Start® Incentive} = (\#\text{ of wall mount} \times \$\,20) + (\#\text{of ceiling mount} \times \$35)$$

$$\text{Smart Start® Incentive} = (2\text{ wall mount} \times \$\,20) + (4\text{ ceiling mount} \times \$35) = \$180$$

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$3,750
NJ Smart Start Equipment Incentive ($):	$180
Net Installation Cost ($):	$3,570
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,912
Total Yearly Savings ($/Yr):	$1,912
Estimated ECM Lifetime (Yr):	15
Simple Payback	1.9
Simple Lifetime ROI	703.2%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$28,676
Internal Rate of Return (IRR)	53%
Net Present Value (NPV)	$19,251.91

ECM #3: Install NEMA Premium® Efficiency Motors

Description:

The improved efficiency of the NEMA Premium® efficient motors is primarily due to better designs with use of better materials to reduce losses. Surprisingly, the electricity used to power a motor represents 95 % of its total lifetime operating cost. Because many motors operate continuously 24 hours a day, even small increases in efficiency can yield substantial energy and dollar savings.

The electric motors driving the air handling unit supply fan motors are the candidates for replacing with premium efficiency motors. These standard efficiency motors run considerable amount of time over a year.

This energy conservation measure replaces existing electric motors over 5 HP or more with NEMA Premium® efficiency motors. NEMA Premium® is the most efficient motor designation in the marketplace today.

IMPLEMENTATION SUMMARY					
EQMT ID	**FUNCTION**	**MOTOR HP**	**HOURS OF OPERATION**	**EXISTING EFFICIENCY**	**NEMA PREMIUM EFFICIENCY**
AC-1	Supply Fan Motor *	5	4,380	*87.5%*	90.2%
AC-2	Supply Fan Motor *	5	4,380	*87.5%*	90.2%
AC-7	Supply Fan Motor *	5	4,380	*87.5%*	90.2%
AC-8	Supply Fan Motor *	7.5	4,380	*89.5%*	91.7%
AC-14	Supply Fan Motor *	20	4,380	*91.0%*	93.0%
** Motor efficiency N/A. Estimated based on EPAct of 1992*					

Energy Savings Calculations:

$$\text{Electric usage, kWh} = \frac{\text{HP} \times \text{LF} \times 0.746 \times \text{Hours of Operation}}{\text{Motor Efficiency}}$$

where, HP = Motor Nameplate Horsepower Rating

LF = Load Factor Motor Efficiency = Motor Nameplate Efficiency

$$\text{Electric Usage Savings, kWh} = \text{Electric Usage}_{\text{Existing}} - \text{Electric Usage}_{\text{Proposed}}$$

$$\text{Electric Usage Savings, kWh} = \text{Electric Usage}_{\text{Existing}} - \text{Electric Usage}_{\text{Proposed}}$$

$$\text{Electric cost savings} = \text{Electric Usage Savings} \times \text{Electric Rate} \left(\frac{\$}{\text{kWh}}\right)$$

The calculations were carried out and the results are tabulated in the table below:

PREMIUM EFFICIENCY MOTOR CALCULATIONS							
EQMT ID	MOTOR HP	LOAD FACTOR	EXISTING EFFICIENCY	NEMA PREMIUM EFFICIENCY	POWER SAVINGS kW	ENERGY SAVINGS kWH	COST SAVINGS
AC-1	5	90%	87.5%	90.2%	0.11	506	$86
AC-2	5	90%	87.5%	90.2%	0.11	506	$86
AC-7	5	90%	87.5%	90.2%	0.11	506	$86
AC-8	7.5	90%	89.5%	91.7%	0.13	594	$101
AC-14	20	90%	91.0%	93.0%	0.32	1,397	$238
TOTAL					**0.8**	**3,509**	**$597**

Equipment Cost and Incentives

Below is a summary of SmartStart Building® incentives for premium efficiency motors on chilled water pumps:

INCENTIVES	
HORSE POWER	NJ SMART START INCENTIVE
5	$60
7.5	$90
10	$100
15	$115
20	$125
25	$130

The following table outlines the summary of motor replacement costs and incentives:

MOTOR REPLACEMENT SUMMARY						
EQMT ID	**MOTOR POWER HP**	**INSTALLED COST**	**SMART START INCENTIVE**	**NET COST**	**TOTAL SAVINGS**	**SIMPLE PAYBACK**
AC-1	5	$1,519	$60	$1,459	$86	17.0
AC-2	5	$1,519	$60	$1,459	$86	17.0
AC-7	5	$1,519	$60	$1,459	$86	17.0
AC-8	7.5	$1,971	$90	$1,881	$101	18.6
AC-14	20	$4,635	$125	$4,510	$238	19.0
TOTAL	**Totals:**	**$11,163**	**$395**	**$10,768**	**$597**	**18.1**

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$11,163
NJ Smart Start Equipment Incentive ($):	$395
Net Installation Cost ($):	$10,768
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$597
Total Yearly Savings ($/Yr):	$597
Estimated ECM Lifetime (Yr):	15
Simple Payback	18.1
Simple Lifetime ROI	-16.9%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$8,948
Internal Rate of Return (IRR)	-2%
Net Present Value (NPV)	($3,646.91)

ECM #4: Install VFDs and Premium Efficiency Motors for Pumps

Description:

The air handling units in this facility utilize a constant speed pumping design. The air handling units have 2-way control valves which allow variable amount of flow through the piping loop. As a result the pumping head and the energy vary as the load in the building changes.

2-way control valves provide flow through the heat exchanger equipment only when there is a call for heating or cooling, unlike 3-way control valves that allow constant flow of the water loop. 3-way control valves require full pumping energy continuously, while 2-way control valves allow the system to reduce flow when it is not needed. Variable frequency drives allow the pumps to slow down in response to a reduction in overall system flow. The reduction in operating flow allows the pumps to reduce energy consumption for all hours that the heating system is not at its peak load.

This ECM includes the installation of Variable Frequency Drives on the existing hot water and chilled water pumps without any modifications to the piping. The VFD's would be controlled by a differential pressure sensor in each water loop to measure demand for water. The furthest air handling unit from the loop pumps would remain as 3-way control valves (constant flow) to eliminate dead heading potential. In addition, a minimum flow amount should be set based on air cooled chiller unloading capability.

This ECM also includes replacement of the existing pump motors with inverter duty motors that meet NEMA Premium Efficiency Standard, which also helps to reduce energy consumption.

Energy and cost savings calculations are based on calculation software "PumpSave v4.2," provided by ABB. The PumpSave calculation software is used to estimate the pumping energy for variable speed pump systems. The hot and chilled water loop pump operations are estimated to be 4,380 Hrs per year since each system is used for about 6 months total. The pump flow, HD, and resultant energy are calculated based on the existing pump horse power installed.

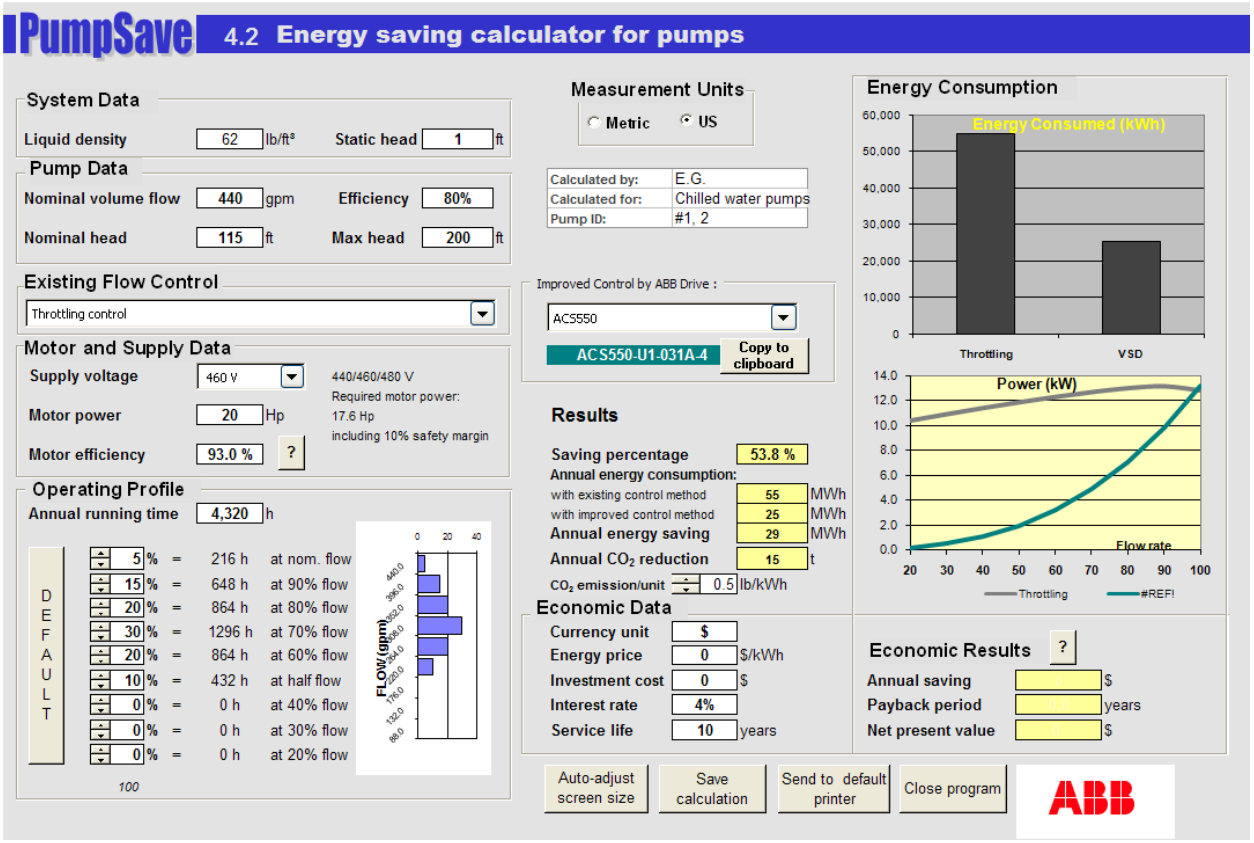
Energy Savings Calculations:

$$\text{Cons. Volume Power}\left(\text{HP}\right) = \frac{\text{Specific Gravity} \times \text{Flow Rate}\left(\frac{\text{Gal}}{\text{min}}\right) \times \text{Head}\left(\text{Ft}\right)}{3960 \times \text{Pump Efficiency}\left(\%\right) \times \text{Motor Efficiency}\left(\%\right)}$$

$$\text{Energy Cons.}\left(\text{kWh}\right) = \text{Power}\left(\text{HP}\right) \times 0.746\left(\frac{\text{KW}}{\text{HP}}\right) \times \text{Operation}\left(\text{Hrs.}\right)$$

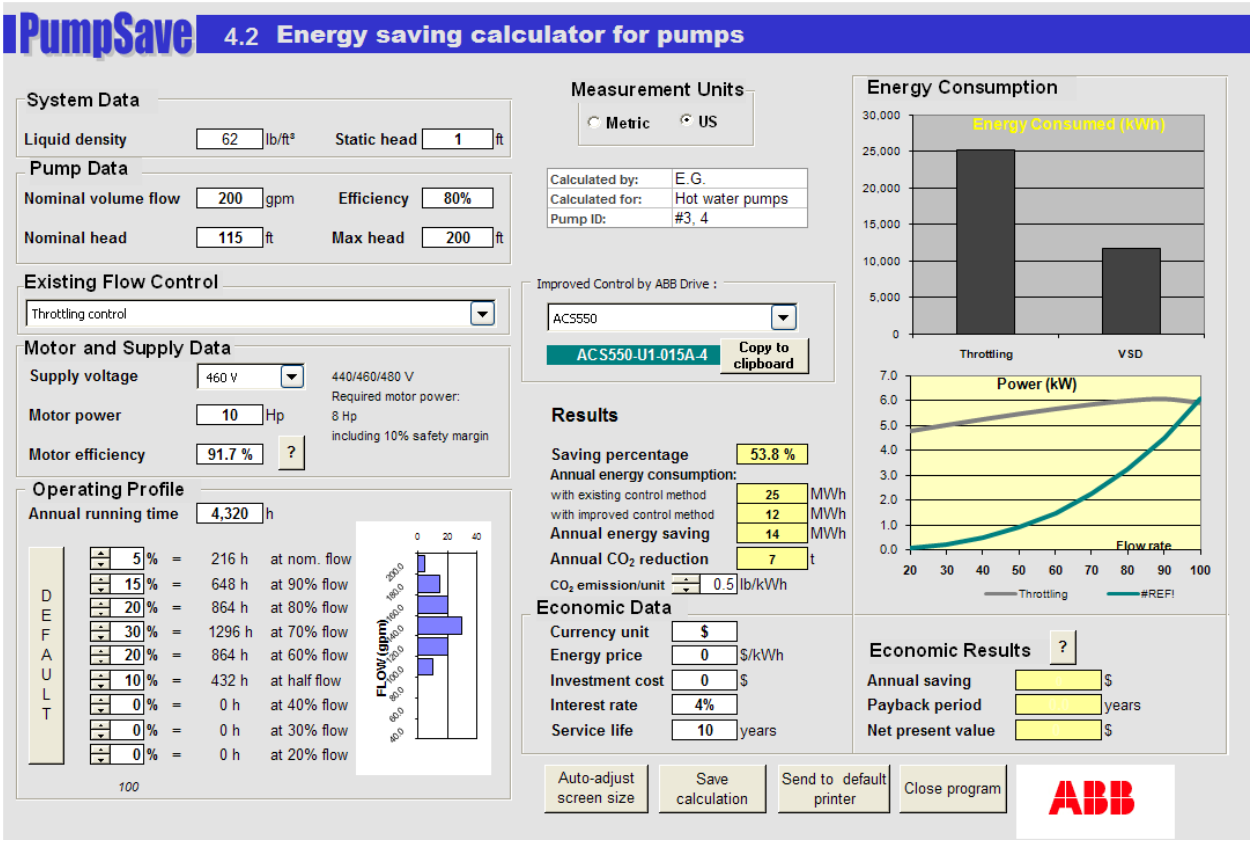
$$\text{Energy Cost} = \text{Energy Usage}\left(\text{kWh}\right) \times \text{Ave Electric Cost}\left(\frac{\$}{\text{kWh}}\right)$$

Chilled Water VFD Pumping Energy:



CHILLED WATER PUMPS VFD CALULATION			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	CV Pumps	VFD Pumps	
Flow Control	Throttling Valves-2Way	VFD	-
Flow* (GPM)	440	440	-
Head* (Ft)	115	115	-
Pump Efficiency (%)	80%	80%	-
Motor Efficiency (%)	91.7%	93.0%	1.3%
Operating Hrs	4320	4320	-
Estimated Power (HP)	17.4	17.2	0.24
Elec Cost ($/kWh)	0.170	0.170	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Energy (kWh)	56,133	25,259	30,874
Electric Energy Cost ($)	$9,543	$4,294	$5,249
COMMENTS:	- VFD pump energy is based on ABB energy savings calculator for pumps, "Pump Save," version 4.2. Flow rate for VFD Pump calculation is summarized in the operating profile shown in the Pump Save output. - Hot water flow & head estimated based on boiler capacity		

Hot Water VFD Pumping Energy:



HOT WATER PUMPS VFD CALULATION			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	CV Pumps	VFD Pumps	
Flow Control	Throttling Valves-2Way	VFD	-
Flow* (GPM)	200	200	-
Head* (Ft)	115	115	-
Pump Efficiency (%)	80%	80%	-
Motor Efficiency (%)	87.5%	91.7%	4.2%
Operating Hrs	4320	4320	-
Estimated Power (HP)	8.3	7.9	0.38
Elec Cost ($/kWh)	0.170	0.170	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Energy (kWh)	26,740	11,644	15,096
Electric Energy Cost ($)	$4,546	$1,980	$2,566
COMMENTS:	- VFD pump energy is based on ABB energy savings calculator for pumps, "Pump Save," version 4.2. Flow rate for VFD Pump calculation is summarized in the operating profile shown in the Pump Save output. - Hot water flow & head estimated based on boiler capacity		

Total installation cost for four (4) VFDs and controls is estimated to be $34,000.

Currently there are no **NJ Smart Start® Program Incentives** for installation of hot water pump Variable Frequency Drives. The incentives are for chilled water pump Frequency Drives over 20HP and above. Therefore, this ECM does not qualify rebates related to Variable Frequency Drives.

Below is a summary of SmartStart Building® incentives for premium efficiency motors for the hot water and chilled water pumps.

INCENTIVES	
HORSE POWER	**NJ SMART START INCENTIVE**
5	$60
7.5	$90
10	$100
15	$115
20	$125
25	$130

Total incentives = 2 x $100 + 2 x $125 = $450

Below table summarizes the total cost and savings due to implementation of this ECM.

VARIABLE SPEED PUMPING SUMMARY			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Energy (kWh)	82,873	36,903	45,969
Electric Energy Cost ($)	$9,543	$4,294	$5,249
COMMENTS:			

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$34,000
NJ Smart Start Equipment Incentive ($):	$450
Net Installation Cost ($):	$33,550
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$5,249
Total Yearly Savings ($/Yr):	$5,249
Estimated ECM Lifetime (Yr):	20
Simple Payback	6.4
Simple Lifetime ROI	212.9%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$104,971
Internal Rate of Return (IRR)	15%
Net Present Value (NPV)	$44,535.45

ECM #5: Window Replacement

Description:

The Williams Center Lobby is enclosed with an architectural glass atrium. The atrium is made up of single pane windows in aluminum frames. The atrium windows are in poor condition with draft issues several water leaks.

The windows account for significant energy use through leakage heat loss and conductive heat loss. The age and condition of the windows contribute to the leakage rate of the building. The single pane construction allows higher thermal (conductive) energy loss. These factors lead to increased energy use in the heating season. The heating loss due to single pane glass is combined with heat loss due to poor seals at each operable window. New double pane windows with low E glazing offer a substantial improvement in thermal performance in the summer months.

This ECM includes the replacement of the glass atrium windows and the older single pane windows in the facility with double pane windows with low emissivity glass. The proposed windows include reduced outside air leakage. In addition the double pane structure will significantly increase the insulation value compared to the existing single pane window structure.

The basis for this ECM is Anderson Windows at $100 per SF of window installed. Below is a list of areas with older and inefficient windows:

WINDOW REPLACEMENT SUMMARY			
ECM INPUTS	**NUMBER OF WINDOWS**	**SIZE**	**AREA**
Atrium Face	Custom	72'x12'	432
Atrium Face		40.5'x12'	486
Atrium Face		12'x12'	144
Atrium Roof		38'x30'	570
Cinema #4 door	1	7'x4'	28
Other	10	3'x4'	120
TOTAL	**11**	**-**	**1780**

Energy Savings Calculations:

$$\text{Infiltration}\left(\frac{\text{Ft}^3}{\text{Min.}}\right) = \text{Window Area}\left(\text{Ft}^2\right) \times \text{Estimated Infiltration per SF of Window}\left(\frac{\text{CFM}}{\text{Ft}^2}\right)$$

$$\text{Heat Load}\left(\frac{\text{Btu}}{\text{Hr.}}\right) = 1.1 \times \text{Infiltration}\left(\frac{\text{Ft}^3}{\text{Min}}\right) \times \text{Design Temperature Difference}\left(^{\circ}\text{F}\right)$$

$$\text{Cooling Load}\left(\text{Ton}\right) = \text{Infiltration}\left(\frac{\text{Ft}^3}{\text{Min}}\right) \times \frac{1\,\text{Ton Cooling}}{400\left(\frac{\text{Ft}^3}{\text{Min}}\right)}$$

$$\text{Heating Leakage Energy}\left(\text{Therms}\right) = \frac{\text{Heat Load}\left(\frac{\text{Btu}}{\text{Hr.}}\right) \times \text{HDD}\left(\text{Day °F}\right) \times 24\left(\frac{\text{Hr.}}{\text{Day}}\right) \times \left(0.60\right)}{65\left(\text{°F}\right) \times \text{Fuel Heat Value}\left(\frac{\text{Btu}}{\text{Therms}}\right) \times \text{Heating Efficiency}\left(\%\right)}$$

$$\text{Cooling Leakage Energy}\left(\text{kWh}\right) = \frac{\text{Cooling Load}\left(\text{Ton}\right) \times \left(\frac{12{,}000\,\text{Btu}}{\text{Ton Hr.}}\right) \times \text{Full Load Cooling Hours}}{\frac{1000\,\text{W.h}}{\text{kWh}} \times \text{Cooling Efficiency}\left(\text{EER}\right)}$$

$$\text{Conductive Energy}\left(\text{Therms}\right) = \frac{\text{U} - \text{Value} \times \text{Area}\left(\text{Ft}^2\right) \times \text{HDD}\left(\text{Day °F}\right) \times 24\left(\frac{\text{Hr.}}{\text{Day}}\right) \times \left(0.60\right)}{65\left(\text{°F}\right) \times \text{Fuel Heat Value}\left(\frac{\text{Btu}}{\text{Therms}}\right) \times \text{Heating Efficiency}\left(\%\right)}$$

$$\text{Heating Energy Cost} = \text{Total Heating Energy}\left(\text{Therms}\right) \times \text{Ave Fuel Cost}\left(\frac{\$}{\text{Therms}}\right)$$

$$\text{Cooling Energy Cost} = \text{Total Cooling Energy}\left(\text{kWh}\right) \times \text{Ave Fuel Cost}\left(\frac{\$}{\text{kWh}}\right)$$

WINDOW REPLACEMENT CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Description:	Existing Single Pane Windows	Double Pane Low-E Windows	-
Window (SF)	1,780	1,780	-
U-Value (BTU/HR/SF*°F)	0.8	0.45	0.35
Estimated Infiltration, CFM per SF Window	3	2	-
Total Infiltration, CFM	5340	3560	1,780
Heating System Efficiency (%)	75%	75%	-
Heating Degree Days (HDD)	4,750	4,750	-
Design Day Temp Diff (°F)	65	65	-
Heating Hrs Per Day (Hrs)	24	24	-
Full Load Cooling Hours	800	800	-
Average Cooling Efficiency, EER	9.0	9.0	-
Gas Cost ($/Therm)	1.02	1.02	-
Electric Cost ($/kWh)	0.182	0.182	-
Gas Heat Value (BTU/Therm)	100,000	100,000	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Heat Load (BTU/Hr)	381,810	254,540	127,270
Leakage Energy (Therms)	5,357	3,571	1,786
Conductive Energy (Therms)	1,299	731	568
Total Heating Energy (Therms)	6,656	4,302	2,354
Cooling Load (Ton)	13	9	4
Cooling Demand (kW)	5.1	3.4	1.7
Total Cooling Energy (kWh)	14,240	9,493	4,747
Gas Energy Cost ($)	$6,789	$4,388	$2,401
Electric Energy Cost ($)	$2,592	$1,728	$864
Comments:	1. Proposed window U-value Based on ASHRAE 90.1 - 2007		

Estimated cost for replacing the inefficient windows at the Williams Center for the Arts is $133,500.

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$133,500
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$133,500
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$3,265
Total Yearly Savings ($/Yr):	$3,265
Estimated ECM Lifetime (Yr):	15
Simple Payback	40.9
Simple Lifetime ROI	-63.3%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$48,973
Internal Rate of Return (IRR)	-11%
Net Present Value (NPV)	($94,524.52)

ECM #6: Demand Controlled Ventilation

Demand Controlled Ventilation (DCV) is a means to provide active, zone level control of ventilation for spaces within a facility. The basic premise behind DCV is monitoring indoor CO2 levels versus outdoor CO2 levels in order to provide proper ventilation to the spaces within the facility as well as saving costly dollars treating unconditioned ventilation air. Carbon dioxide ventilation control or demand controlled ventilation (DCV) allows for the measurement and control of outside air ventilation levels to a target cfm/person ventilation rate in the space (i.e., 15 cfm/person) based on the number of people in the space. It is a direct measure of ventilation effectiveness and is a method whereby buildings can regain active and automatic zone level ventilation control, without having to open windows. The fixed ventilation approach depends on a set-it-and-forget-it methodology that is completely unresponsive to changes in the way spaces are utilized/occupied or how equipment is maintained. A DCV system utilizes various control algorithms to maintain a base ventilation rate. The system monitors space CO2 levels and the algorithm automatically adjusts the outdoor and return air dampers to provide the quantity of outdoor air to maintain the required CO2 level in the space. System designs are normally designed for maximum occupancy and the ventilation rates are designed for this (maximum) occupancy. In areas where occupancy swings are prevalent there is ample opportunity to reduce outdoor air quantity to satisfy the needs of the actual number of occupants present. By installing the DCV controls, energy savings are realized by the reduced quantities of outdoor air that do not require heating and cooling energy from the steam and chilled water plants.

The air handling units serving the lobby areas, theatres and the concession areas are standard air conditioning systems with constant minimum outside air setup. When these units are on unoccupied mode, the outside air dampers shut. The outside air volume is typically based on the maximum occupancy of the space conditioned. When a given space is not fully occupied the outside air quantity delivered to the space is greater than the amount actually needed for adequate ventilation, which results in waste of heating or air conditioning energy.

This ECM includes the installation integrated demand control ventilation systems with CO2 sensors, for the units mentioned above. This system allows the air handling unit to respond to changes in occupancy and therefore reduce the amount of outside air that has to be conditioned. Outside air accounts for a large portion of the energy consumption in the HVAC system, especially in high occupancy spaces. The U.S. Department of Energy sponsored a study to analyze energy savings achieved through various types of building system controls. The referenced savings is based on the "Advanced Sensors and Controls for Building Applications: Market Assessment and Potential R&D Pathways," document posted for public use April 2005. The study has found that commercial buildings have the potential to achieve significant energy savings through the use of building controls. The average energy savings are as follows based on the report:

- Demand Control Ventilation - 10% - 15%.

Energy savings achieved through "Demand Control Ventilation" average 10%-15%. Savings resulting from the implementation of this ECM for energy management controls are estimated to be 15% of the total HVAC energy cost for this system.

The components included to install for a demand control ventilation system include damper actuators (if not exist), Variable Frequency Drives (if not exist), CO2 sensors, wiring, Energy Management System equipment expansion and programming. Each occupied zone would require minimum one CO_2 sensor installed to monitor occupancy levels.

IMPLEMENTATION SUMMARY						
INPUTS	**HVAC Unit**	**Service**	**Total Flow Capacity CFM**	**Min # of CO2 SENSORS**	**Cooling Capaity, Tons**	**Heating Capacity, MBH**
DCV-1	AC-1	Concession Area	4,000	1	10.2	114
DCV-2	AC-2	Concession Area	2,000	1	6.9	58
DCV-3	AC-3	Theatre #2	5,700	2	17.5	182
DCV-4	AC-4	Theatre #1	4,410	2	10.4	91
DCV-5	AC-5	Theatre #2A	1,850	2	5.2	53
DCV-7	AC-7	Theatre #3	3,300	2	9.9	170
DCV-8	AC-8	Mezz, Lobby	5,700	2	13.0	270
DCV-14	AC-14	Main Theatre	23,000	2	79.8	1,340
Total				**14**	**153**	**2,278**

Energy Savings Calculations:

$$\text{Cooling EnergyUsage} = \frac{\text{Cooling(Tons)} \times 12{,}000\left(\frac{\text{Btu}}{\text{Ton hr}}\right) \times \text{Annual Full Load Cooling Hrs.}}{1000\left(\frac{\text{Wh}}{\text{kWh}}\right) \times \text{EER}\left(\frac{\text{Btu}}{\text{Wh}}\right)}$$

$$\text{EnergySavings} = \text{CoolingEnergy(kwh)} \times 15\%$$

$$\text{Cooling Cost} = \text{Energy Usage(kWh)} \times \text{Ave Electric Cost}\left(\frac{\$}{\text{kWh}}\right)$$

$$\text{Heating Energy (Therms)} = \frac{\text{Heating Capacity}\left(\frac{\text{Btu}}{\text{Hr.}}\right) \times \text{HDD(Day °F)} \times 24\left(\frac{\text{Hr.}}{\text{Day}}\right) \times (0.60)}{65(°\text{F}) \times \text{Fuel Heat Value}\left(\frac{\text{Btu}}{\text{Therms}}\right) \times \text{Heating Efficiency (\%)}}$$

$$\text{Heating Cost} = \text{Heating Energy}(\text{Therms}) \times \text{Ave Fuel Cost}\left(\frac{\$}{\text{Therms}}\right)$$

$$\text{EnergySavings} = \text{HeatingEnergy}(\text{Therms}) \times 15\%$$

Results of the energy savings calculations are summarized in the table below:

DEMAND CONTROLLED VENTILATION	
ECM INPUTS	**DCV-1-8, 14**
Equipment	AHUs
Total Cooling Capacity, Tons	153
Efficiency (EER)	9
Annual Full Load Cooling Hours	800
Total Heating Capacity, MBh	2278
Heating Efficiency (Gas)	75%
Heating Degree Days (65°F)	4599
Energy Savings	15.0%
Elec Cost ($/kWh)	$0.182
Natural Gas Cost ($/Therm)	$1.02
ENERGY SAVINGS	
ECM RESULTS	**DCV-1-8, 14**
Cooling Energy Cnsmption, kWh	163,236
Heating Energy (Therms)	30,946
Cooling Energy Savings kWh	24,485
Heating Energy Savings (Therms)	4,642
Electric Energy Cost Savings ($)	$4,456
Total Gas Cost Savings ($)	$4,735
Total Cost Savings ($)	$9,191
COMMENTS:	HDD estimated based on Newark,NJ.

Cost and Incentives:

Estimated installed cost for demand controlled ventilation for the air handling units serving the lobby areas, theatres and the concession areas is $128,000. Estimated cost includes CO2 sensors, control wiring, electrical wiring, VFDs, control system equipment expansion and programming. There are currently no Smart Start ® incentives available for a Demand Control Ventilation System.

Energy Savings Summary:

ECM #6 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$128,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$128,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$9,191
Total Yearly Savings ($/Yr):	$9,191
Estimated ECM Lifetime (Yr):	15
Simple Payback	13.9
Simple Lifetime ROI	7.7%
Simple Lifetime Maintenance Savings	0
Simple Lifetime Savings	$137,866
Internal Rate of Return (IRR)	1%
Net Present Value (NPV)	($18,277.56)

REM #1: 11.3 kW Rooftop Solar Array

Description:

The Williams Center has approximately 800 square-foot of available roof space that can accommodate an 11.3 kilowatt solar array, assuming the existing roof structure is capable of supporting an array.

The array will produce approximately 14,185 kilowatt-hours annually that will reduce the overall electric usage of the facility by 3%.

Energy Savings Calculations:

See **Renewable / Distributed Energy Measures Calculations Appendix** for detailed financial summary and proposed solar layout areas.

Energy Savings Summary:

REM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$101,430
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$101,430
Maintenance Savings ($/Yr):	$4,965
Energy Savings ($/Yr):	$2,582
Total Yearly Savings ($/Yr):	$7,546
Estimated ECM Lifetime (Yr):	15
Simple Payback	13.4
Simple Lifetime ROI	11.6%
Simple Lifetime Maintenance Savings	$74,471
Simple Lifetime Savings	$113,196
Internal Rate of Return (IRR)	1%
Net Present Value (NPV)	($11,341.33)

V. ADDITIONAL RECOMMENDATIONS

The following recommendations include no cost/low cost measures, Operation & Maintenance (O&M) items, and water conservation measures with attractive paybacks. These measures are not eligible for the Smart Start Buildings incentives from the office of Clean Energy but save energy none the less.

A. Chemically clean the condenser and evaporator coils periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%.

B. Maintain all weather stripping on windows and doors.

C. Clean all light fixtures to maximize light output.

D. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.

E. Ensure outside air dampers are functioning properly and only open during occupied mode.

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Bergen County - Williams Center for the Arts

ECM ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN (IRR)	NET PRESENT VALUE (NPV)
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT. / SREC	TOTAL		(Yearly Saving * ECM Lifetime)	(Yearly Maint Svaing * ECM Lifetime)	(Lifetime Savings - Net Cost) / (Net Cost)	(Net cost / Yearly Savings)	$\sum_{n=0}^{N} \frac{C_n}{(1+IRR)^n}$	$\sum_{n=0}^{N} \frac{C_n}{(1+DR)^n}$
		($)	($)	($)	($)	($/Yr)	($/Yr)	($/Yr)	(Yr)	($)	($)	(%)	(Yr)	($)	($)
ECM #1	Lighting Equipment Upgrade	$6,335	$9,502	$2,050	$13,787	$8,321	$323	$8,644	15	$129,661	$4,841	840.5%	1.6	62.65%	$89,405.50
ECM #2	Lighting Controls Upgrade	$1,500	$2,250	$180	$3,570	$1,912	$0	$1,912	15	$28,676	$0	703.2%	1.9	53.46%	$19,251.91
ECM #3	Premium Efficiency Motors	$11,163	$0	$395	$10,768	$597	$0	$597	15	$8,948	$0	-16.9%	18.1	-2.23%	($3,646.91)
ECM #4	Variable Frequency Drives on Pump Motors	$13,600	$20,400	$450	$33,550	$5,249	$0	$5,249	20	$104,971	$0	212.9%	6.4	14.62%	$44,535.45
ECM #5	Window Replacement	$133,500	$0	$0	$133,500	$3,265	$0	$3,265	15	$48,973	$0	-63.3%	40.9	-10.53%	($94,524.52)
ECM #6	Demand Controlled Ventilation	$128,000	$0	$0	$128,000	$9,191	$0	$9,191	15	$137,866	$0	7.7%	13.9	0.94%	($18,277.56)
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	Solar Photovoltaic System	$101,430	$0	$0	$101,430	$2,582	$4,965	$7,546	15	$113,196	$74,471	11.6%	13.4	1.40%	($11,341.33)

Notes: 1) The variable Cn in the formulas for Internal Rate of Return and Net Present Value stands for the cash flow during each period.
2) The variable DR in the NPV equation stands for Discount Rate
3) For NPV and IRR calculations: From n=0 to N periods where N is the *lifetime of ECM* and Cn is the *cash flow during each period* .

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SmartStart Building Incentives

The NJ SmartStart Buildings Program offers financial incentives on a wide variety of building system equipment. The incentives were developed to help offset the initial cost of energy-efficient equipment. The following tables show the current available incentives as of February 15, 2011:

Electric Chillers

Water-Cooled Chillers	$12 - $170 per ton
Air-Cooled Chillers	$8 - $52 per ton

Energy Efficiency must comply with ASHRAE 90.1-2007

Gas Cooling

Gas Absorption Chillers	$185 - $400 per ton
Gas Engine-Driven Chillers	Calculated through custom measure path)

Desiccant Systems

$1.00 per cfm – gas or electric

Electric Unitary HVAC

Unitary AC and Split Systems	$73 - $92 per ton
Air-to-Air Heat Pumps	$73 - $92 per ton
Water-Source Heat Pumps	$81 per ton
Packaged Terminal AC & HP	$65 per ton
Central DX AC Systems	$40- $72 per ton
Dual Enthalpy Economizer Controls	$250
Occupancy Controlled Thermostat (Hospitality & Institutional Facility)	$75 per thermostat

Energy Efficiency must comply with ASHRAE 90.1-2007

Gas Heating

Gas Fired Boilers < 300 MBH	$300 per unit
Gas Fired Boilers ≥ 300 - 1500 MBH	$1.75 per MBH
Gas Fired Boilers ≥1500 - ≤ 4000 MBH	$1.00 per MBH
Gas Fired Boilers > 4000 MBH	(Calculated through Custom Measure Path)
Gas Furnaces	$300 - $400 per unit, AFUE ≥ 92%

Ground Source Heat Pumps

Closed Loop	$450 per ton, EER ≥ 16 $600 per ton, EER ≥ 18 $750 per ton, EER ≥ 20

Energy Efficiency must comply with ASHRAE 90.1-2007

Variable Frequency Drives

Variable Air Volume	$65 - $155 per hp
Chilled-Water Pumps	$60 per VFD rated hp
Compressors	$5,250 to $12,500 per drive
Cooling Towers ≥ 10 hp	$60 per VFD rated hp

Natural Gas Water Heating

Gas Water Heaters ≤ 50 gallons, 0.67 energy factor or better	$50 per unit
Gas-Fired Water Heaters > 50 gallons	$1.00 - $2.00 per MBH
Gas-Fired Booster Water Heaters	$17 - $35 per MBH
Gas Fired Tankless Water Heaters	$300 per unit

Prescriptive Lighting

Retro fit of T12 to T-5 or T-8 Lamps w/Electronic Ballast in Existing Facilities	$10 per fixture (1-4 lamps)
Replacement of T12 with new T-5 or T-8 Lamps w/Electronic Ballast in Existing Facilities	$25 per fixture (1-4 lamps)
Replacement of incandescent with screw-in PAR 38 or PAR 30 (CFL) bulb	$7 per bulb
T-8 reduced Wattage (28w/25w 4', 1-4 lamps) Lamp & ballast replacement	$10 per fixture
Hard-Wired Compact Fluorescent	$25 - $30 per fixture
Metal Halide w/Pulse Start Including Parking Lot	$25 per fixture
T-5 and T-8 High Bay Fixtures	$16 - $200 per fixture
HID ≥ 100w Retrofit with induction lamp, power coupler and generator (must be 30% less watts/fixture than HID system)	$50 per fixture
HID ≥ 100w Replacement with new HID ≥ 100w	$70 per fixture

Prescriptive Lighting - LED

LED New Exit Sign Fixture Existing Facility < 75 kw Existing Facility > 75 kw	 $20 per fixture $10 per fixture
LED Display Case Lighting	$30 per display case
LED Shelf-Mtd. Display & Task Lights	$15 per linear foot
LED Portable Desk Lamp	$20 per fixture
LED Wall-wash Lights	$30 per fixture
LED Recessed Down Lights	$35 per fixture
LED Outdoor Pole/Arm-Mounted Area and Roadway Luminaries	$175 per fixture
LED Outdoor Pole/Arm-Mounted Decorative Luminaries	$175 per fixture
LED Outdoor Wall-Mounted Area Luminaries	$100 per fixture
LED Parking Garage Luminaries	$100 per fixture
LED Track or Mono-Point Directional Lighting Fixtures	$50 per fixture
LED High-Bay and Low-Bay Fixtures for Commercial & Industrial Bldgs.	$150 per fixture
LED High-Bay-Aisle Lighting	$150 per fixture
LED Bollard Fixtures	$50 per fixture
LED Linear Panels (2x2 Troffers only)	$100 per fixture
LED Fuel Pump Canopy	$100 per fixture
LED Refrigerator/Freezer case lighting replacement of fluorescent in medium and low temperature display case	$42 per 5 foot $65 per 6 foot

Lighting Controls – Occupancy Sensors

Wall Mounted	$20 per control
Remote Mounted	$35 per control
Daylight Dimmers	$25 per fixture
Occupancy Controlled hi-low Fluorescent Controls	$25 per fixture controlled

Lighting Controls – HID or Fluorescent Hi-Bay Controls

Occupancy hi-low	$75 per fixture controlled
Daylight Dimming	$75 per fixture controlled
Daylight Dimming - office	$50 per fixture controlled

Premium Motors

Three-Phase Motors	$45 - $700 per motor
Fractional HP Motors Electronic Communicated Motors (replacing shaded pole motors in refrigerator/freezer cases)	$40 per electronic communicated motor

Other Equipment Incentives

Performance Lighting	$1.00 per watt per SF below program incentive threshold, currently 5% more energy efficient than ASHRAE 90.1-2007 for New Construction and Complete Renovation
Custom Electric and Gas Equipment Incentives	not prescriptive
Custom Measures	$0.16 KWh and $1.60/Therm of 1st year savings, or a buy down to a 1 year payback on estimated savings. Minimum required savings of 75,000 KWh or 1,500 Therms and a IRR of at least 10%.
Multi Measures Bonus	15%

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Williams Center for the Arts

Building ID: 2610915
For 12-month Period Ending: February 28, 2011[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: May 16, 2011

Facility
Williams Center for the Arts
17 Sylvan St.
Rutherford, NJ 07070

Facility Owner
County of Bergen
One Bergen Plaza
Hackensack, NJ 07601

Primary Contact for this Facility
Thomas Connolly
One Bergen Plaza
Hackensack, NJ 07601

Year Built: 1920
Gross Floor Area (ft²): 39,144

Energy Performance Rating[2] (1-100) N/A

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	1,588,171
Natural Gas (kBtu)[4]	2,497,163
Total Energy (kBtu)	4,085,334

Energy Intensity[5]

Site (kBtu/ft²/yr)	104
Source (kBtu/ft²/yr)	202

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	358

Electric Distribution Utility
Public Service Electric & Gas Co

National Average Comparison

National Average Site EUI	95
National Average Source EUI	265
% Difference from National Average Source EUI	-24%
Building Type	Entertainment/Culture

Stamp of Certifying Professional

Based on the conditions observed at the time of my visit to this building, I certify that the information contained within this statement is accurate.

Meets Industry Standards[6] **for Indoor Environmental Conditions:**

Ventilation for Acceptable Indoor Air Quality	**N/A**
Acceptable Thermal Environmental Conditions	**N/A**
Adequate Illumination	**N/A**

Certifying Professional
Michael Fischette
520 S. Burnt Mill Rd.
Voorhees, NJ 08043

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Values represent energy intensity, annualized to a 12-month period.
5. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

ENERGY STAR® Data Checklist for Commercial Buildings

In order for a building to qualify for the ENERGY STAR, a Professional Engineer (PE) or a Registered Architect (RA) must validate the accuracy of the data underlying the building's energy performance rating. This checklist is designed to provide an at-a-glance summary of a property's physical and operating characteristics, as well as its total energy consumption, to assist the PE or RA in double-checking the information that the building owner or operator has entered into Portfolio Manager.

Please complete and sign this checklist and include it with the stamped, signed Statement of Energy Performance.
NOTE: You must check each box to indicate that each value is correct, OR include a note.

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Building Name	Williams Center for the Arts	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	Entertainment/Culture	Is this an accurate description of the space in question?		☐
Location	17 Sylvan St. , Rutherford, NJ 07070	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		☐
Single Structure	Single Facility	Does this SEP represent a single structure? SEPs cannot be submitted for multiple-building campuses (with the exception of acute care or children's hospitals) nor can they be submitted as representing only a portion of a building		☐
Theatre (Other)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	39,144 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Number of PCs	5(Optional)	Is this the number of personal computers in the space?		☐
Weekly operating hours	80Hours(Optional)	Is this the total number of hours per week that the space is 75% occupied? This number should exclude hours when the facility is occupied only by maintenance, security, or other support personnel. For facilities with a schedule that varies during the year, "operating hours/week" refers to the total weekly hours for the schedule most often followed.		☐
Workers on Main Shift	10(Optional)	Is this the number of employees present during the main shift? Note this is not the total number of employees or visitors who are in a building during an entire 24 hour period. For example, if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100.		☐

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: Public Service Electric & Gas Co

Fuel Type: Electricity		
Meter: 278003797 (kWh (thousand Watt-hours)) **Space(s):** Entire Facility **Generation Method:** Grid Purchase		
Start Date	**End Date**	**Energy Use (kWh (thousand Watt-hours))**
01/06/2011	02/03/2011	1,170.00
12/04/2010	01/05/2011	2,640.00
11/03/2010	12/03/2010	1,830.00
10/05/2010	11/02/2010	1,230.00
09/04/2010	10/04/2010	750.00
08/05/2010	09/03/2010	1,230.00
07/07/2010	08/04/2010	1,050.00
06/05/2010	07/06/2010	2,490.00
05/06/2010	06/04/2010	1,560.00
04/08/2010	05/05/2010	810.00
03/05/2010	04/07/2010	1,080.00
278003797 Consumption (kWh (thousand Watt-hours))		**15,840.00**
278003797 Consumption (kBtu (thousand Btu))		**54,046.08**
Meter: 778013328 (kWh (thousand Watt-hours)) **Space(s):** Entire Facility **Generation Method:** Grid Purchase		
Start Date	**End Date**	**Energy Use (kWh (thousand Watt-hours))**
01/06/2011	02/03/2011	30,200.00
12/04/2010	01/05/2011	33,000.00
10/05/2010	12/03/2010	54,600.00
09/04/2010	10/04/2010	44,200.00
08/05/2010	09/03/2010	55,400.00
07/07/2010	08/04/2010	58,000.00
06/05/2010	07/06/2010	52,200.00
05/06/2010	06/04/2010	37,600.00
04/07/2010	05/05/2010	27,200.00
03/06/2010	04/06/2010	27,000.00
778013328 Consumption (kWh (thousand Watt-hours))		**419,400.00**
778013328 Consumption (kBtu (thousand Btu))		**1,430,992.80**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**1,485,038.88**

Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?	☐

Fuel Type: Natural Gas		
Meter: 3499913 (therms) **Space(s):** Entire Facility		
Start Date	**End Date**	**Energy Use (therms)**
01/06/2011	02/03/2011	6,065.93
12/04/2010	01/05/2011	6,389.77
11/03/2010	12/03/2010	2,751.63
10/05/2010	11/02/2010	972.53
09/04/2010	10/04/2010	92.09
08/05/2010	09/03/2010	0.00
07/07/2010	08/04/2010	0.00
06/05/2010	07/06/2010	3.04
05/06/2010	06/04/2010	311.70
04/07/2010	05/05/2010	890.56
03/05/2010	04/06/2010	2,746.57
3499913 Consumption (therms)		**20,223.82**
3499913 Consumption (kBtu (thousand Btu))		**2,022,382.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**2,022,382.00**
Is this the total Natural Gas consumption at this building including all Natural Gas meters?		☐

Additional Fuels	
Do the fuel consumption totals shown above represent the total energy use of this building? Please confirm there are no additional fuels (district energy, generator fuel oil) used in this facility.	☐

On-Site Solar and Wind Energy	
Do the fuel consumption totals shown above include all on-site solar and/or wind power located at your facility? Please confirm that no on-site solar or wind installations have been omitted from this list. All on-site systems must be reported.	☐

Certifying Professional

(When applying for the ENERGY STAR, the Certifying Professional must be the same PE or RA that signed and stamped the SEP.)

Name: _____ Date: _____

Signature: _____

Signature is required when applying for the ENERGY STAR.

FOR YOUR RECORDS ONLY. DO NOT SUBMIT TO EPA.

Please keep this Facility Summary for your own records; do not submit it to EPA. Only the Statement of Energy Performance (SEP), Data Checklist and Letter of Agreement need to be submitted to EPA when applying for the ENERGY STAR.

Facility
Williams Center for the Arts
17 Sylvan St.
Rutherford, NJ 07070

Facility Owner
County of Bergen
One Bergen Plaza
Hackensack, NJ 07601

Primary Contact for this Facility
Thomas Connolly
One Bergen Plaza
Hackensack, NJ 07601

General Information

Williams Center for the Arts	
Gross Floor Area Excluding Parking: (ft^2)	39,144
Year Built	1920
For 12-month Evaluation Period Ending Date:	February 28, 2011

Facility Space Use Summary

Theatre	
Space Type	Other - Entertainment/Culture
Gross Floor Area(ft^2)	39,144
Number of PCs[o]	5
Weekly operating hours[o]	80
Workers on Main Shift[o]	10

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 02/28/2011)	**Baseline** (Ending Date 02/28/2011)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	N/A	N/A	75	N/A	N/A
Energy Intensity					
Site (kBtu/ft²)	104	104	0	N/A	95
Source (kBtu/ft²)	202	202	0	N/A	265
Energy Cost					
$/year	$ 110,790.63	$ 110,790.63	N/A	N/A	$ 100,844.21
$/ft²/year	$ 2.83	$ 2.83	N/A	N/A	$ 2.58
Greenhouse Gas Emissions					
$MtCO_2e$/year	358	358	0	N/A	326
$kgCO_2e/ft^2$/year	9	9	0	N/A	8

More than 50% of your building is defined as Entertainment/Culture. This building is currently ineligible for a rating. Please note the National Average column represents the CBECS national average data for Entertainment/Culture. This building uses X% less energy per square foot than the CBECS national average for Entertainment/Culture.

Notes:
o - This attribute is optional.
d - A default value has been supplied by Portfolio Manager.

MAJOR EQUIPMENT LIST

Concord Engineering Group

Bergen County - Williams Center

Boilers

Tag	Boiler-1 & 2		
Unit Type	Gas fired, water tube		
Qty	2		
Location	Boiler room		
Area Served	Air handling units		
Manufacturer	Paterson Kelley		
Model #	N-1900-2		
Serial #	CY12-09-33386, CY12-09-33387		
Input Capacity (MBH)	1,900		
Rated Output Capacity (MBH)	1,615		
Approx. Efficiency %	85%		
Fuel	Natural Gas		
Approx Age	2		
ASHRAE Service Life	30		
Remaining Life	28		
Comments	High efficiency non-condensing HW boilers		

MAJOR EQUIPMENT LIST

Concord Engineering Group

Bergen County - Williams Center

Chiller

Tag	CH-1		
Unit Type	Air cooled water chiller with helical rotary screw compressors		
Qty	1		
Location	Platform		
Area Served	Air Handing Units		
Manufacturer	TRANE		
Model #	RTAC 2004 UR0N UAFN N1TY 1DDN NN0E N10A R0EX N		
Serial #	U09E04117		
Refrigerant	R143A		
Cooling Capacity (Tons)	200		
Cooling Efficiency (KW/Ton)	1.241 kW/Ton, 9.7 EER (Full Load)		
Volts / Phase / Hz	460/3/60		
Fuel	Electricity		
Chilled Water GPM / ΔT	-		
Condenser Water GPM / ΔT	-		
Approx Age	2		
ASHRAE Service Life	20		
Remaining Life	18		
Comments	Standard efficiency unit		

MAJOR EQUIPMENT LIST

Concord Engineering Group

Bergen County - Williams Center

Pumps

Tag	P #1 & 2	#3 & 4	P-5 & 6
Unit Type	Base mounted, constant volume, chilled water pump	Base mounted, constant volume, hot water pump secondary loop	Pipe mounted, primary hot water loop pumps
Qty	2	2	2
Location	3rd Floor MER (Icebox room)	Boiler room	Boiler room
Area Served	Air handling units	Secondary hot water loop - AHUs	Primary hot water loop - AHUs
Manufacturer	Taco	Taco	Emerson
Model #	C13013E2LAAB7010	SD40030-4	-
Serial #	EC49371/6	-	-
Horse Power	20	10	3/4
Flow	440	-	-
Motor Info	-	Baldor Motor	Emerson
Electrical Power	460 / 3 / 60	460 / 3 / 60	-
RPM	1760	1755	1725
Motor Efficiency %	91.7%	87.5%	-
Approx Age	2	2	2
ASHRAE Service Life	20	20	20
Remaining Life	18	18	18
Comments		Standard efficiency motors	

MAJOR EQUIPMENT LIST

Concord Engineering Group

Bergen County - Williams Center

Domestic Water Heaters

Tag	HWH-1		
Unit Type	Electric hot water heater		
Qty	1		
Location	Stage bathrooms		
Area Served	Stage bathrooms		
Manufacturer	Rheem		
Model #	81V40D		
Serial #	0591Z06947		
Size (Gallons)	40		
Input Capacity (MBH/KW)	4.5 kW		
Recovery (Gal/Hr)	-		
Efficiency %	-		
Fuel	Electricity		
Approx Age	2		
ASHRAE Service Life	12		
Remaining Life	10		
Comments			

MAJOR EQUIPMENT LIST

Concord Engineering Group

Bergen County - Williams Center

Air Handling Units

Tag	AC-1	AC-2	AC-3
Unit Type	AHU with Hot and Chilled Water Coils	AHU with Hot and Chilled Water Coils	AHU with Hot and Chilled Water Coils
Qty	1	1	1
Location	Air Handler Room	Air Handler Room	Air Handler Room
Area Served	Concession Area	Concession Area	Theatre #2
Manufacturer	McQuay	McQuay	McQuay
Model #	LSL111CH	LSL106CH	LSL111CV
Serial #	3LA00077-04	3LA00076-04	3LA00078-04
Flow Capacity (CFM)	4000	2000	5700
Outside Air Flow (CFM)	650	490	1425
Cooling Type	Chilled Water	Chilled Water	Chilled Water
Cooling Capacity (Tons)	122.6 MBH	82.4 MBH	210.5 MBH
Cooling Efficiency (SEER/EER)	-	-	-
Heating Type	Hot Water	Hot Water	Hot Water
Heating Input (MBH)	114 MBH	58 MBH	182 MBH
Approx Age	15+	15+	15+
ASHRAE Service Life	15	15	15
Remaining Life	0	0	0
Comments	5 HP Motor (Estimated)	5 HP Motor (Estimated)	3 HP Standard Eff. Motor, 82.5 % Eff

MAJOR EQUIPMENT LIST

Concord Engineering Group

Bergen County - Williams Center

Air Handling Units

Tag	AC-4	AC-5	AC-6
Unit Type	AHU with Hot and Chilled Water Coils	AHU with Hot and Chilled Water Coils	AHU with Hot and Chilled Water Coils
Qty	1	1	1
Location	Air Handler Room	Air Handler Room	Icebox Room
Area Served	Theatre #1	Theatre #2A	Offices
Manufacturer	McQuay	McQuay	McQuay
Model #	LSL111CV	LSL108CV	-
Serial #	3LA00079-04	3LA00080-04	-
Flow Capacity (CFM)	4410	1850	800
Outside Air Flow (CFM)	1100	415	60
Cooling Type	Chilled Water	Chilled Water	Chilled Water
Cooling Capacity (Tons)	125 MBH	62.5 MBH	20 MBH
Cooling Efficiency (SEER/EER)	-	-	-
Heating Type	Hot Water	Hot Water	Hot Water
Heating Input (MBH)	91 MBH	53 MBH	23 MBH
Approx Age	15+	15+	2
ASHRAE Service Life	15	15	15
Remaining Life	0	0	13
Comments	Small Motor (Info N/A)	2 HP Standard Eff. Motor, 80% Eff	1/2 HP motor

MAJOR EQUIPMENT LIST

Concord Engineering Group

Bergen County - Williams Center

Air Handling Units

Tag	AC-7	AC-8	AC-14
Unit Type	AHU with Hot and Chilled Water Coils	AHU with Hot and Chilled Water Coils	AHU with Hot and Chilled Water Coils
Qty	1	1	1
Location	Icebox Room	Icebox Room	Icebox Room
Area Served	Theatre #3	Mezz, Lobby	Main Theatre
Manufacturer	McQuay	McQuay	Trane
Model #	-	-	CCDB35MNEM V5A5L11LLAP
Serial #	-	-	K92H39452
Flow Capacity (CFM)	3300	5700	23000
Outside Air Flow (CFM)	825	850	5720
Cooling Type	Chilled Water	Chilled Water	Chilled Water
Cooling Capacity (Tons)	119 MBH	156.4 MBH	958 MBH
Cooling Efficiency (SEER/EER)	-	-	-
Heating Type	Hot Water	Hot Water	Hot Water
Heating Input (MBH)	170 MBH	270 MBH	1340 MBH
Approx Age	2	2	19 (Est)
ASHRAE Service Life	15	15	15
Remaining Life	13	13	0
Comments	5 HP Motor (info N/A)	7.5 HP Motor (info N/A)	20 HP Standard Eff. PTFE Motor

Investment Grade Lighting Audit

CEG Job #: 9C10088
Project: Williams Center
15 Sylvan St
Rutherford NJ
Bldg. Sq. Ft. 39,144

Williams Center

KWH COST: $0.182

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
626	Atrium	3000	10	8	Strip Light, (8) 40w G40 Lamp	320	3.20	9,600.0	$1,747.20	10	8	14w G40 CFL Lamp	112	1.12	3360	$611.52	$100.00	$1,000.00	2.08	6240	$1,135.68	0.88
626	2nd Floor Concourse	3000	11	8	Strip Light, (8) 40w G40 Lamp	320	3.52	10,560.0	$1,921.92	11	8	14w G40 CFL Lamp	112	1.23	3696	$672.67	$100.00	$1,100.00	2.29	6864	$1,249.25	0.88
555	Movie Theater	2000	20	1	Recessed Down Light, 65w BR30 Lamp	65	1.30	2,600.0	$473.20	20	1	Energy Star Rated Dimmable 26w CFL Lamp	26	0.52	1040	$189.28	$20.00	$400.00	0.78	1560	$283.92	1.41
227.21	Stairwell	3000	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.07	195.0	$35.49	1	2	Sylvania Lamp FBO30/841XP/6//SS/ECO	49	0.05	147	$26.75	$24.00	$24.00	0.02	48	$8.74	2.75
122.21	Maintenance	1000	3	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	78	0.23	234.0	$42.59	3	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.15	150	$27.30	$80.00	$240.00	0.08	84	$15.29	15.70
142.21	Boiler Room	1200	2	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	156	0.31	374.4	$68.14	2	3	3 Lamp , 28w T8, Elect. Ballast, Specular Reflector; retrofit	72	0.14	172.8	$31.45	$100.00	$200.00	0.17	201.6	$36.69	5.45
221.11		1200	2	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.12	148.8	$27.08	2	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.10	120	$21.84	$14.00	$28.00	0.02	28.8	$5.24	5.34
232.22	Office	2600	8	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	0.69	1,788.8	$325.56	8	3	Relamp - Sylvania Lamp FO28/841/SS/ECO	72	0.58	1497.6	$272.56	$21.00	$168.00	0.11	291.2	$53.00	3.17
247.22		2600	1	4	2x2, 4 Lamp, 17w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	68	0.07	176.8	$32.18	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
612	Mech Room	1000	4	1	Pendant Mnt., 100w A19 Lamp	100	0.40	400.0	$72.80	4	1	(1) 26w CFL Lamp	26	0.10	104	$18.93	$20.00	$80.00	0.30	296	$53.87	1.49
555	Small Office	2600	6	1	Recessed Down Light, 65w BR30 Lamp	65	0.39	1,014.0	$184.55	6	1	Energy Star Rated Dimmable 26w CFL Lamp	26	0.16	405.6	$73.82	$20.00	$120.00	0.23	608.4	$110.73	1.08
564		2600	4	1	Track Head, 50w R20	50	0.20	520.0	$94.64	4	1	13w R20 CFL Lamp	13	0.05	135.2	$24.61	$20.00	$80.00	0.15	384.8	$70.03	1.14
121.14	Elevator Car	8760	1	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.08	683.3	$124.36	1	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.05	438	$79.72	$80.00	$80.00	0.03	245.28	$44.64	1.79
609	Men's Restroom	3000	1	10	Strip Light, (10) 40w G40 Lamp	400	0.40	1,200.0	$218.40	1	2	Wall Mnt., 2 Lamp T8 28w, Prismatic lens	50	0.05	150	$27.30	$200.00	$200.00	0.35	1050	$191.10	1.05
555		3000	5	1	Recessed Down Light, 65w BR30 Lamp	65	0.33	975.0	$177.45	5	1	Energy Star Rated Dimmable 26w CFL Lamp	26	0.13	390	$70.98	$20.00	$100.00	0.20	585	$106.47	0.94
609	Women's Restroom	3000	1	10	Strip Light, (10) 40w G40 Lamp	400	0.40	1,200.0	$218.40	1	2	Wall Mnt., 2 Lamp T8 28w, Prismatic lens	50	0.05	150	$27.30	$200.00	$200.00	0.35	1050	$191.10	1.05
555		3000	5	1	Recessed Down Light, 65w BR30 Lamp	65	0.33	975.0	$177.45	5	1	Energy Star Rated Dimmable 26w CFL Lamp	26	0.13	390	$70.98	$20.00	$100.00	0.20	585	$106.47	0.94
122.11	Dressing Area	1200	2	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.16	187.2	$34.07	2	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.10	120	$21.84	$80.00	$160.00	0.06	67.2	$12.23	13.08
142.11	Dressing Area Restroom	1200	1	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	156	0.16	187.2	$34.07	1	3	3 Lamp , 28w T8, Elect. Ballast, Specular Reflector; retrofit	72	0.07	86.4	$15.72	$100.00	$100.00	0.08	100.8	$18.35	5.45
627		1200	1	3	Strip Light, (3) 40w G40 Lamp	120	0.12	144.0	$26.21	1	3	14w G40 CFL Lamp	42	0.04	50.4	$9.17	$60.00	$60.00	0.08	93.6	$17.04	3.52
142.11	Prop Room	1200	3	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	156	0.47	561.6	$102.21	3	3	3 Lamp , 28w T8, Elect. Ballast, Specular Reflector; retrofit	72	0.22	259.2	$47.17	$100.00	$300.00	0.25	302.4	$55.04	5.45
628		2000	4	1	500w Quartz Light	500	2.00	4,000.0	$728.00	4	1	175w Pulse Start Metal Halide Flood Light	185	0.74	1480	$269.36	$220.00	$880.00	1.26	2520	$458.64	1.92

Investment Grade Lighting Audit

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
629	Assembly Area	2000	7	1	Step Light 20w	20	0.14	280.0	$50.96	7	1	5w LED Lamp	5	0.04	70	$12.74	$24.00	$168.00	0.11	210	$38.22	4.40
630		2000	1	48	Hanging Chandelier, (48) 75w A Lamp	3600	3.60	7,200.0	$1,310.40	1	48	9w LED Lamp	432	0.43	864	$157.25	$2,800.00	$2,800.00	3.17	6336	$1,153.15	2.43
628	Stage	2000	2	1	500w Quartz Light	500	1.00	2,000.0	$364.00	2	1	175w Pulse Start Metal Halide Flood Light	185	0.37	740	$134.68	$220.00	$440.00	0.63	1260	$229.32	1.92
629	Ramp/Walkway	2000	8	1	Step Light 20w	20	0.16	320.0	$58.24	8	1	5w LED Lamp	5	0.04	80	$14.56	$24.00	$192.00	0.12	240	$43.68	4.40
555		2000	7	1	Recessed Down Light, 65w BR30 Lamp	65	0.46	910.0	$165.62	7	1	Energy Star Rated Dimmable 26w CFL Lamp	26	0.18	364	$66.25	$20.00	$140.00	0.27	546	$99.37	1.41
628		2000	1	1	500w Quartz Light	500	0.50	1,000.0	$182.00	1	1	175w Pulse Start Metal Halide Flood Light	185	0.19	370	$67.34	$220.00	$220.00	0.32	630	$114.66	1.92
555	Control Room	2000	2	1	Recessed Down Light, 65w BR30 Lamp	65	0.13	260.0	$47.32	2	1	Energy Star Rated Dimmable 26w CFL Lamp	26	0.05	104	$18.93	$20.00	$40.00	0.08	156	$28.39	1.41
611	Seating Area	2000	10	1	Wall Mnt. Globe, (1) 100w A19 Lamps	100	1.00	2,000.0	$364.00	10	1	Energy Star Rated, Dimmable 26w CFL Lamp	26	0.26	520	$94.64	$20.00	$200.00	0.74	1480	$269.36	0.74
555		2000	2	1	Recessed Down Light, 65w BR30 Lamp	65	0.13	260.0	$47.32	2	1	Energy Star Rated Dimmable 26w CFL Lamp	26	0.05	104	$18.93	$20.00	$40.00	0.08	156	$28.39	1.41
121.21	Old Dressing Room - Lower	1200	5	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	78	0.39	468.0	$85.18	5	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.25	300	$54.60	$80.00	$400.00	0.14	168	$30.58	13.08
121.21		1200	2	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	78	0.16	187.2	$34.07	2	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.10	120	$21.84	$80.00	$160.00	0.06	67.2	$12.23	13.08
142.11	Old Dressing Room - Upper	1200	3	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	156	0.47	561.6	$102.21	3	3	3 Lamp , 28w T8, Elect. Ballast, Specular Reflector; retrofit	72	0.22	259.2	$47.17	$100.00	$300.00	0.25	302.4	$55.04	5.45
142.11	Restroom	1200	1	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	156	0.16	187.2	$34.07	1	3	3 Lamp , 28w T8, Elect. Ballast, Specular Reflector; retrofit	72	0.07	86.4	$15.72	$100.00	$100.00	0.08	100.8	$18.35	5.45
555	Stairway to Dressing Rooms	1200	2	1	Recessed Down Light, 65w BR30 Lamp	65	0.13	156.0	$28.39	2	1	Energy Star Rated Dimmable 26w CFL Lamp	26	0.05	62.4	$11.36	$20.00	$40.00	0.08	93.6	$17.04	2.35
227.21	Lower Level Common Area	3000	4	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.26	780.0	$141.96	4	2	Sylvania Lamp FBO30/841XP/6//SS/ECO	49	0.20	588	$107.02	$24.00	$96.00	0.06	192	$34.94	2.75
227.21	Hall	3000	3	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.20	585.0	$106.47	3	2	Sylvania Lamp FBO30/841XP/6//SS/ECO	49	0.15	441	$80.26	$24.00	$72.00	0.05	144	$26.21	2.75
227.21	Concession	2000	5	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.33	650.0	$118.30	5	2	Sylvania Lamp FBO30/841XP/6//SS/ECO	49	0.25	490	$89.18	$24.00	$120.00	0.08	160	$29.12	4.12
227.21	Eating Area	2000	3	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.20	390.0	$70.98	3	2	Sylvania Lamp FBO30/841XP/6//SS/ECO	49	0.15	294	$53.51	$24.00	$72.00	0.05	96	$17.47	4.12
121.21	Kitchen	2000	5	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	78	0.39	780.0	$141.96	5	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.25	500	$91.00	$80.00	$400.00	0.14	280	$50.96	7.85
127.15	Stairway to Lower Theaters	3000	1	2	2x2, 2 Lamp, 34w T12, Mag. Ballast, Surface Mnt., White Lens	65	0.07	195.0	$35.49	1	2	2x2, 2 Lamp, 14w T5, Indirect; Fixture	31	0.03	93	$16.93	$215.00	$215.00	0.03	102	$18.56	11.58
609	Men's Restroom	3000	1	10	Strip Light, (10) 40w G40 Lamp	400	0.40	1,200.0	$218.40	1	2	Wall Mnt., 2 Lamp T8 28w, Prismatic lens	50	0.05	150	$27.30	$200.00	$200.00	0.35	1050	$191.10	1.05
555		3000	5	1	Recessed Down Light, 65w BR30 Lamp	65	0.33	975.0	$177.45	5	1	Energy Star Rated Dimmable 26w CFL Lamp	26	0.13	390	$70.98	$20.00	$100.00	0.20	585	$106.47	0.94
609	Women's Restroom	3000	1	10	Strip Light, (10) 40w G40 Lamp	400	0.40	1,200.0	$218.40	1	2	Wall Mnt., 2 Lamp T8 28w, Prismatic lens	50	0.05	150	$27.30	$200.00	$200.00	0.35	1050	$191.10	1.05
555		3000	5	1	Recessed Down Light, 65w BR30 Lamp	65	0.33	975.0	$177.45	5	1	Energy Star Rated Dimmable 26w CFL Lamp	26	0.13	390	$70.98	$20.00	$100.00	0.20	585	$106.47	0.94
555	Cinema 3	2000	8	1	Recessed Down Light, 65w BR30 Lamp	65	0.52	1,040.0	$189.28	8	1	Energy Star Rated Dimmable 26w CFL Lamp	26	0.21	416	$75.71	$20.00	$160.00	0.31	624	$113.57	1.41
555	Projector Room	2000	2	1	Recessed Down Light, 65w BR30 Lamp	65	0.13	260.0	$47.32	2	1	Energy Star Rated Dimmable 26w CFL Lamp	26	0.05	104	$18.93	$20.00	$40.00	0.08	156	$28.39	1.41
555	Cinema 2	2000	2	1	Recessed Down Light, 65w BR30 Lamp	65	0.13	260.0	$47.32	2	1	Energy Star Rated Dimmable 26w CFL Lamp	26	0.05	104	$18.93	$20.00	$40.00	0.08	156	$28.39	1.41

Investment Grade Lighting Audit

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING								SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
555.1	~~Cinema 2~~	2000	7	1	Industrial Reflector, Down Light, 65w BR30 Lamp	65	0.46	910.0	$165.62	7	1	Energy Star Rated Dimmable 26w CFL Lamp	26	0.18	364	$66.25	$20.00	$140.00	0.27	546	$99.37	1.41
121.11	Projector Room	2000	3	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.23	468.0	$85.18	3	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.15	300	$54.60	$100.00	$300.00	0.08	168	$30.58	9.81
555.1	Cinema 1	2000	13	1	Industrial Reflector, Down Light, 65w BR30 Lamp	65	0.85	1,690.0	$307.58	13	1	Energy Star Rated Dimmable 26w CFL Lamp	26	0.34	676	$123.03	$20.00	$260.00	0.51	1014	$184.55	1.41
555		2000	2	1	Recessed Down Light, 65w BR30 Lamp	65	0.13	260.0	$47.32	2	1	Energy Star Rated Dimmable 26w CFL Lamp	26	0.05	104	$18.93	$20.00	$40.00	0.08	156	$28.39	1.41
227.21	Maintenance Corridor	3000	13	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.85	2,535.0	$461.37	13	2	Sylvania Lamp FBO30/841XP/6//SS/ECO	49	0.64	1911	$347.80	$24.00	$312.00	0.21	624	$113.57	2.75
121.34	Boiler Room	1200	8	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., No Lens	78	0.62	748.8	$136.28	8	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.40	480	$87.36	$80.00	$640.00	0.22	268.8	$48.92	13.08
128.14	Storage 1	1200	1	2	8' Channel, 2 Lamp, 75w T12, Mag. Ballast, Surface Mnt., No Lens	142	0.14	170.4	$31.01	1	4	(2) 8' Lamps to (4) 4' Lamps - 28w T8, Elect Ballast; retrofit	98	0.10	117.6	$21.40	$100.00	$100.00	0.04	52.8	$9.61	10.41
128.14	Storage 2	1200	1	2	8' Channel, 2 Lamp, 75w T12, Mag. Ballast, Surface Mnt., No Lens	142	0.14	170.4	$31.01	1	4	(2) 8' Lamps to (4) 4' Lamps - 28w T8, Elect Ballast; retrofit	98	0.10	117.6	$21.40	$100.00	$100.00	0.04	52.8	$9.61	10.41
121.31		1200	2	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., Prismatic Lens	78	0.16	187.2	$34.07	2	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.10	120	$21.84	$80.00	$160.00	0.06	67.2	$12.23	13.08
622	Exterior	4400	6	1	Double Head Flood, (2) 90w PAR Lamps	180	1.08	4,752.0	$864.86	6	1	70w MH Wallpack	80	0.48	2112	$384.38	$185.00	$1,110.00	0.60	2640	$480.48	2.31
	Totals		250	197				74,697	$13,595	250	160			12.3	28,798	$5,241		$15,837	19.3	45,722	$8,321	1.90

CEG Job #: 9C10088
Project: Williams Center
Address: 15 Sylvan St
Rutherford NJ
Building SF: 39,144

Williams Center

KWH COST: $0.182

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
626	Atrium	3000	10	8	Strip Light, (8) 40w G40 Lamp	320	3.2	9600	$1,747.20	10	1	Daylight Sensor (Sensorswitch PP-20 & CM-PC or equal)	320	1.92	40%	5760	$1,048.32	$400.00	$400.00	1.28	3840	$698.88	0.57
626	2nd Floor Concourse	3000	11	8	Strip Light, (8) 40w G40 Lamp	320	3.52	10560	$1,921.92	11	1	Daylight Sensor (Sensorswitch PP-20 & CM-PC or equal)	320	2.11	40%	6336	$1,153.15	$400.00	$400.00	1.41	4224	$768.77	0.52
555	Movie Theater	2000	20	1	Recessed Down Light, 65w BR30 Lamp	65	1.3	2600	$473.20	20	0	No Change	65	1.30	0%	2600	$473.20	$0.00	$0.00	0.00	0	$0.00	0.00
227.21	Stairwell	3000	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.065	195	$35.49	1	0	No Change	65	0.07	0%	195	$35.49	$0.00	$0.00	0.00	0	$0.00	0.00
122.21	Maintenance	1000	3	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	78	0.234	234	$42.59	3	0	No Change	78	0.23	0%	234	$42.59	$0.00	$0.00	0.00	0	$0.00	0.00
142.21	Boiler Room	1200	2	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	156	0.312	374.4	$68.14	2	0	No Change	156	0.31	0%	374.4	$68.14	$0.00	$0.00	0.00	0	$0.00	0.00
221.11		1200	2	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.124	148.8	$27.08	2	0	No Change	62	0.12	0%	148.8	$27.08	$0.00	$0.00	0.00	0	$0.00	0.00
232.22	Office	2600	8	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	0.688	1788.8	$325.56	8	1	Dual Technology Occupancy Sensor - Switch Mnt.	86	0.55	20%	1431.04	$260.45	$125.00	$125.00	0.14	357.76	$65.11	1.75
247.22		2600	1	4	2x2, 4 Lamp, 17w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	68	0.068	176.8	$32.18	1			68	0.05	20%	141.44	$25.74			0.01	35.36	$6.44	
612	Mech Room	1000	4	1	Pendant Mnt., 100w A19 Lamp	100	0.4	400	$72.80	4	0	No Change	100	0.40	0%	400	$72.80	$0.00	$0.00	0.00	0	$0.00	0.00
555	Small Office	2600	6	1	Recessed Down Light, 65w BR30 Lamp	65	0.39	1014	$184.55	6	1	Dual Technology Occupancy Sensor - Switch Mnt.	65	0.31	20%	811.2	$147.64	$125.00	$125.00	0.08	202.8	$36.91	2.24
564		2600	4	1	Track Head, 50w R20	50	0.2	520	$94.64	4			50	0.16	20%	416	$75.71	$125.00	$0.00	0.04	104	$18.93	
121.14	Elevator Car	8760	1	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.078	683.28	$124.36	1	0	No Change	78	0.08	0%	683.28	$124.36	$0.00	$0.00	0.00	0	$0.00	0.00
609	Men's Restroom	3000	1	10	Strip Light, (10) 40w G40 Lamp	400	0.4	1200	$218.40	1	1	Dual Technology Occupancy Sensor	400	0.32	20%	960	$174.72	$450.00	$450.00	0.08	240	$43.68	5.68

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
555	Men's Restroom	3000	5	1	Recessed Down Light, 65w BR30 Lamp	65	0.325	975	$177.45	5	1	Occupancy Sensor - Remote Mnt.	65	0.26	20%	780	$141.96	$450.00	$0.00	0.07	195	$35.49	5.68
609	Women's Restroom	3000	1	10	Strip Light, (10) 40w G40 Lamp	400	0.4	1200	$218.40	1	1	Dual Technology Occupancy Sensor - Remote Mnt.	400	0.32	20%	960	$174.72	$450.00	$450.00	0.08	240	$43.68	5.68
555	Women's Restroom	3000	5	1	Recessed Down Light, 65w BR30 Lamp	65	0.325	975	$177.45	5	1	Dual Technology Occupancy Sensor - Remote Mnt.	65	0.26	20%	780	$141.96	$450.00	$0.00	0.07	195	$35.49	5.68
122.11	Dressing Area	1200	2	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.156	187.2	$34.07	2	0	No Change	78	0.16	0%	187.2	$34.07	$0.00	$0.00	0.00	0	$0.00	0.00
142.11	Dressing Area Restroom	1200	1	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	156	0.156	187.2	$34.07	1	0	No Change	156	0.16	0%	187.2	$34.07	$0.00	$0.00	0.00	0	$0.00	0.00
627	Dressing Area Restroom	1200	1	3	Strip Light, (3) 40w G40 Lamp	120	0.12	144	$26.21	1	0	No Change	120	0.12	0%	144	$26.21	$0.00	$0.00	0.00	0	$0.00	0.00
142.11	Prop Room	1200	3	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	156	0.468	561.6	$102.21	3	0	No Change	156	0.47	0%	561.6	$102.21	$0.00	$0.00	0.00	0	$0.00	0.00
628	Assembly Area	2000	4	1	500w Quartz Light	500	2	4000	$728.00	4	0	No Change	500	2.00	0%	4000	$728.00	$0.00	$0.00	0.00	0	$0.00	0.00
629	Assembly Area	2000	7	1	Step Light 20w	20	0.14	280	$50.96	7	0	No Change	20	0.14	0%	280	$50.96	$0.00	$0.00	0.00	0	$0.00	0.00
630	Assembly Area	2000	1	48	Hanging Chandelier, (48) 75w A Lamp	3600	3.6	7200	$1,310.40	1	0	No Change	3600	3.60	0%	7200	$1,310.40	$0.00	$0.00	0.00	0	$0.00	0.00
628	Stage	2000	2	1	500w Quartz Light	500	1	2000	$364.00	2	0	No Change	500	1.00	0%	2000	$364.00	$0.00	$0.00	0.00	0	$0.00	0.00
629	Ramp/Walkway	2000	8	1	Step Light 20w	20	0.16	320	$58.24	8	0	No Change	20	0.16	0%	320	$58.24	$0.00	$0.00	0.00	0	$0.00	0.00
555	Ramp/Walkway	2000	7	1	Recessed Down Light, 65w BR30 Lamp	65	0.455	910	$165.62	7	0	No Change	65	0.46	0%	910	$165.62	$0.00	$0.00	0.00	0	$0.00	0.00
628	Ramp/Walkway	2000	1	1	500w Quartz Light	500	0.5	1000	$182.00	1	0	No Change	500	0.50	0%	1000	$182.00	$0.00	$0.00	0.00	0	$0.00	0.00
555	Control Room	2000	2	1	Recessed Down Light, 65w BR30 Lamp	65	0.13	260	$47.32	2	0	No Change	65	0.13	0%	260	$47.32	$0.00	$0.00	0.00	0	$0.00	0.00

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
611	Seating Area	2000	10	1	Wall Mnt. Globe, (1) 100w A19 Lamps	100	1	2000	$364.00	10	0	No Change	100	1.00	0%	2000	$364.00	$0.00	$0.00	0.00	0	$0.00	0.00
555		2000	2	1	Recessed Down Light, 65w BR30 Lamp	65	0.13	260	$47.32	2	0	No Change	65	0.13	0%	260	$47.32	$0.00	$0.00	0.00	0	$0.00	0.00
121.21	Old Dressing Room - Lower	1200	5	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	78	0.39	468	$85.18	5	0	No Change	78	0.39	0%	468	$85.18	$0.00	$0.00	0.00	0	$0.00	0.00
121.21		1200	2	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	78	0.156	187.2	$34.07	2	0	No Change	78	0.16	0%	187.2	$34.07	$0.00	$0.00	0.00	0	$0.00	0.00
142.11	Old Dressing Room - Upper	1200	3	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	156	0.468	561.6	$102.21	3	0	No Change	156	0.47	0%	561.6	$102.21	$0.00	$0.00	0.00	0	$0.00	0.00
142.11	Restroom	1200	1	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	156	0.156	187.2	$34.07	1	0	No Change	156	0.16	0%	187.2	$34.07	$0.00	$0.00	0.00	0	$0.00	0.00
555	Stairway to Dressing Rooms	1200	2	1	Recessed Down Light, 65w BR30 Lamp	65	0.13	156	$28.39	2	0	No Change	65	0.13	0%	156	$28.39	$0.00	$0.00	0.00	0	$0.00	0.00
227.21	Lower Level Common Area	3000	4	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.26	780	$141.96	4	0	No Change	65	0.26	0%	780	$141.96	$0.00	$0.00	0.00	0	$0.00	0.00
227.21	Hall	3000	3	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.195	585	$106.47	3	0	No Change	65	0.20	0%	585	$106.47	$0.00	$0.00	0.00	0	$0.00	0.00
227.21	Concession	2000	5	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.325	650	$118.30	5	0	No Change	65	0.33	0%	650	$118.30	$0.00	$0.00	0.00	0	$0.00	0.00
227.21	Eating Area	2000	3	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.195	390	$70.98	3	0	No Change	65	0.20	0%	390	$70.98	$0.00	$0.00	0.00	0	$0.00	0.00
121.21	Kitchen	2000	5	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	78	0.39	780	$141.96	5	0	No Change	78	0.39	0%	780	$141.96	$0.00	$0.00	0.00	0	$0.00	0.00
127.15	Stairway to Lower Theaters	3000	1	2	2x2, 2 Lamp, 34w T12, Mag. Ballast, Surface Mnt., White Lens	65	0.065	195	$35.49	1	0	No Change	65	0.07	0%	195	$35.49	$0.00	$0.00	0.00	0	$0.00	0.00
609	Men's Restroom	3000	1	10	Strip Light, (10) 40w G40 Lamp	400	0.4	1200	$218.40	1	1	Dual Technology Occupancy Sensor - Remote Mnt.	400	0.32	20%	960	$174.72	$900.00	$900.00	0.08	240	$43.68	11.37
555		3000	5	1	Recessed Down Light, 65w BR30 Lamp	65	0.325	975	$177.45	5			65	0.26	20%	780	$141.96			0.07	195	$35.49	

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
609	Women's Restroom	3000	1	10	Strip Light, (10) 40w G40 Lamp	400	0.4	1200	$218.40	1	1	Dual Technology Occupancy Sensor - Remote Mnt.	400	0.32	20%	960	$174.72	$900.00	$900.00	0.08	240	$43.68	11.37
555		3000	5	1	Recessed Down Light, 65w BR30 Lamp	65	0.325	975	$177.45	5			65	0.26	20%	780	$141.96			0.07	195	$35.49	
555	Cinema 3	2000	8	1	Recessed Down Light, 65w BR30 Lamp	65	0.52	1040	$189.28	8	0	No Change	65	0.52	0%	1040	$189.28	$0.00	$0.00	0.00	0	$0.00	0.00
555	Projector Room	2000	2	1	Recessed Down Light, 65w BR30 Lamp	65	0.13	260	$47.32	2	0	No Change	65	0.13	0%	260	$47.32	$0.00	$0.00	0.00	0	$0.00	0.00
555	Cinema 2	2000	2	1	Recessed Down Light, 65w BR30 Lamp	65	0.13	260	$47.32	2	0	No Change	65	0.13	0%	260	$47.32	$0.00	$0.00	0.00	0	$0.00	0.00
555.1		2000	7	1	Industrial Reflector, Down Light, 65w BR30 Lamp	65	0.455	910	$165.62	7	0	No Change	65	0.46	0%	910	$165.62	$0.00	$0.00	0.00	0	$0.00	0.00
121.11	Projector Room	2000	3	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.234	468	$85.18	3	0	No Change	78	0.23	0%	468	$85.18	$0.00	$0.00	0.00	0	$0.00	0.00
555.1	Cinema 1	2000	13	1	Industrial Reflector, Down Light, 65w BR30 Lamp	65	0.845	1690	$307.58	13	0	No Change	65	0.85	0%	1690	$307.58	$0.00	$0.00	0.00	0	$0.00	0.00
555		2000	2	1	Recessed Down Light, 65w BR30 Lamp	65	0.13	260	$47.32	2	0	No Change	65	0.13	0%	260	$47.32	$0.00	$0.00	0.00	0	$0.00	0.00
227.21	Maintenance Corridor	3000	13	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.845	2535	$461.37	13	0	No Change	65	0.85	0%	2535	$461.37	$0.00	$0.00	0.00	0	$0.00	0.00
121.34	Boiler Room	1200	8	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., No Lens	78	0.624	748.8	$136.28	8	0	No Change	78	0.62	0%	748.8	$136.28	$0.00	$0.00	0.00	0	$0.00	0.00
128.14	Storage 1	1200	1	2	8' Channel, 2 Lamp, 75w T12, Mag. Ballast, Surface Mnt., No Lens	142	0.142	170.4	$31.01	1	0	No Change	142	0.14	0%	170.4	$31.01	$0.00	$0.00	0.00	0	$0.00	0.00
128.14	Storage 2	1200	1	2	8' Channel, 2 Lamp, 75w T12, Mag. Ballast, Surface Mnt., No Lens	142	0.142	170.4	$31.01	1	0	No Change	142	0.14	0%	170.4	$31.01	$0.00	$0.00	0.00	0	$0.00	0.00
121.31		1200	2	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., Prismatic Lens	78	0.156	187.2	$34.07	2	0	No Change	78	0.16	0%	187.2	$34.07	$0.00	$0.00	0.00	0	$0.00	0.00
622	Exterior	4400	6	1	Double Head Flood, (2) 90w PAR Lamps	180	1.08	4752	$864.86	6	0	No Change	180	1.08	0%	4752	$864.86	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		250	197			31.7	74,696.9	$13,595	250	8			28.1		64,193.0	$11,683.12		$3,750	3.54	10,504	$1,912	1.96

Project Name: **LGEA Solar PV Project - Williams Center**
Location: **Rutherford, NJ**
Description: **Photovoltaic System - Direct Purchase**

Simple Payback Analysis

	Photovoltaic System - Direct Purchase
Total Construction Cost	$101,430
Annual kWh Production	14,185
Annual Energy Cost Reduction	$2,582
Annual SREC Revenue	$4,965
First Cost Premium	**$101,430**
Simple Payback:	**13.44** **Years**

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.182**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/kWh)	$0.350

Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Net Cash Flow	Cumulative Cash Flow
0	$101,430	0	0	0	$0	(101,430)	0
1	$0	14,185	$2,582	$0	$4,965	$7,546	($93,884)
2	$0	14,114	$2,659	$0	$4,940	$7,599	($86,285)
3	$0	14,044	$2,739	$0	$4,915	$7,654	($78,630)
4	$0	13,973	$2,821	$0	$4,891	$7,712	($70,919)
5	$0	13,903	$2,906	$143	$4,866	$7,629	($63,290)
6	$0	13,834	$2,993	$142	$4,842	$7,692	($55,598)
7	$0	13,765	$3,083	$142	$4,818	$7,759	($47,839)
8	$0	13,696	$3,175	$141	$4,794	$7,828	($40,012)
9	$0	13,627	$3,270	$140	$4,770	$7,900	($32,112)
10	$0	13,559	$3,368	$140	$4,746	$7,975	($24,137)
11	$0	13,491	$3,470	$139	$4,722	$8,053	($16,085)
12	$0	13,424	$3,574	$138	$4,698	$8,134	($7,951)
13	$0	13,357	$3,681	$138	$4,675	$8,218	$267
14	$0	13,290	$3,791	$137	$4,652	$8,306	$8,573
15	$0	13,224	$3,905	$136	$4,628	$8,397	$16,970
16	$0	13,158	$4,022	$136	$4,605	$8,492	$25,462
17	$0	13,092	$4,143	$135	$4,582	$8,590	$34,052
18	$0	13,026	$4,267	$134	$4,559	$8,692	$42,744
19	$0	12,961	$4,395	$134	$4,536	$8,798	$51,542
20	$0	12,896	$4,527	$133	$4,514	$8,908	$60,450
21	$1	12,832	$4,663	$132	$4,491	$9,022	$69,472
22	$2	12,768	$4,803	$132	$4,469	$9,140	$78,612
23	$3	12,704	$4,947	$131	$4,446	$9,262	$87,874
24	$4	12,640	$5,095	$130	$4,424	$9,389	$97,263
25	$5	12,577	$5,248	$130	$4,402	$9,520	$106,784
	Totals:	334,141	$94,126	$2,862	$116,949	$208,214	$63,324
				Net Present Value (NPV)		**$106,809**	
				Internal Rate of Return (IRR)		**6.2%**	

Building	Roof Area (sq ft)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW_{DC}	Total Annual kWh	Panel Weight (33 lbs)	W/SQFT
Bergen County Williams Center	800	Sunpower SPR230	49	14.7	721	11.27	14,185	1,617	15.64

.= Proposed PV Layout

Notes:

1. Estimated kWH based on the National Renewable Energy Laboratory PVWatts Version 1 Calculator Program.

AC Energy & Cost Savings

Cautions for Interpreting the Results

(Type comments here to appear on printout; maximum 1 row of 80 characters.)

Station Identification	
City:	Atlantic_City
State:	New_Jersey
Latitude:	39.45° N
Longitude:	74.57° W
Elevation:	20 m
PV System Specifications	
DC Rating:	11.3 kW
DC to AC Derate Factor:	0.810
AC Rating:	9.1 kW
Array Type:	Fixed Tilt
Array Tilt:	15.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	11.2 ¢/kWh

Results

Month	Solar Radiation (kWh/m^2/day)	AC Energy (kWh)	Energy Value ($)
1	2.80	805	90.16
2	3.53	922	103.26
3	4.46	1248	139.78
4	5.28	1395	156.24
5	5.86	1572	176.06
6	6.10	1520	170.24
7	6.05	1542	172.70
8	5.60	1432	160.38
9	4.99	1255	140.56
10	3.97	1054	118.05
11	2.86	762	85.34
12	2.43	678	75.94
Year	4.50	14185	1588.72

Output Hourly Performance Data

About the Hourly Performance Data

Output Results as Text

Saving Text from a Browser

Run PVWATTS v.1 for another US location or an International location
Run PVWATTS v.2 (US only)

Please send questions and comments regarding PVWATTS to Webmaster

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